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NOTE.

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For either purpose indexes will be published. The annual index will appear year by year, the "serial" indexes at wider intervals.

The annual index refers to the numbering which heads the pages ; the numbering at the foot, which is consecutive in each Series, will be used in the serial indexes.

Public libraries and similar institutions are likely to find the plan of binding in annual volumes the more convenient one.

I. HENRY BURKILL,

Assistant Reporter on Economic Products to the Government of India.

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1900—No. 1.

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THE AGRICULTURAL LEDGER.

1900—No. 1.

(REPRINT FROM MADRAS BULLETIN No. 37.)

ARACHIS HYPOGÆA.

[*Dictionary of Economic Products, Vol. I.*, A. 1261-72.]

THE GROUND-NUT.

By C. BENSON, ESQ., M.R.A.C., *Deputy Director of Land Records and Agriculture, Madras.*

Readers of the *Agricultural Ledger* No. 15 of 1893, especially those who are interested in Ground-nut cultivation and trade, will doubtless be glad to get Mr. Benson's concise and interesting account of the vicissitudes of the crop as it occurs in the Madras Presidency.

That account has, with the kind permission of the Board of Revenue, Madras, been reprinted from the Madras Bulletin No. 37, and must be considered to form a most useful supplement to the Editor's paper published as *Agricultural Ledger* No. 15 of 1893.

Trade.

In a review * of the trade in ground-nuts and ground-nut oil prepared some years ago, it was shown that during the four years ending in 1891 the average export trade by sea was as follows:—

		Cwt.
Nuts exported	from French ports . .	1,219,350
	from Madras ports . .	660,000
Exports of ground-nut oil = nuts † about .		200,000
TOTAL .		2,079,350

* *Vide* Madras Bulletin No. 28.
† Assuming one hundredweight of seeds to yield 5 gallons of oil.

ARACHIS hypogæa. — The Ground-nut.

TRADE.

The export trade in ground-nut oil was then centred at Pondicherry, from which port during the four years ending in 1891 an average of 936,600 gallons of oil had been exported annually, and in 1892, which was a bad year, 722,785 gallons. The bulk of the exports of this oil has always been despatched to Burma, and though data are not at present available as to the details of the exports from Pondicherry for recent years, the following figures show that in 1894 a great change took place in the course of the trade. The figures below show the imports of ground-nut oil into Indian ports from Pondicherry, and the exports from Madras ports for a series of years:—

Decrease.

Year.	Imports from Pondicherry.	Exports from Madras ports.
	Gals.	Gals.
1890-91	762,195	41,275
1891-92	724,603	21,979
1892-93	770,981	14,295
1893-94	869,800	8,717
1894-95	165,858	567,375
1895-96	64,259	690,134
1896-97	23,019	571,860
1897-98	9,040	571,614

An examination of the statistics also shows that the oil that was formerly shipped at Pondicherry is now sent away from Cuddalore.

The exports of ground-nuts from French ports also fell off greatly especially in 1897 as shown by the figures noted on the margin, and have since become so small that they are not noted in the latest statistical return of the exports from French ports. The figures are borne out and confirmed by the statistics of the quantities of ground-nuts carried to Pondicherry by rail from British territory, which may be summarised as follows:—

	Cwt.
1895	638,640
1896	190,846
1897	6,397

	Cwt.
Average during the four years ending 1895-96	443,223
During 1896-97	81,079
During 1897-98	3,319
During 1898-99	11,390

The amount of ground-nuts that is carried into Pondicherry by road is not known, but the data given above together with those

ARACHIS hypogæa.

TRADE.

Madras sea-borne.

summarised in the following table, showing the trade of Madras sea-ports, are sufficient to demonstrate the great falling off that has occurred in the available surplus of these nuts :—

During the period ending	Exports of ground-nuts.			Exports of ground-nut oil.			Exports of oil = nuts.†	Grand Total of Exports.
	Foreign.	Coastwise.	Total.	Foreign.	Coastwise.	Total.		
	Cwt.	Cwt.	Cwt.	Gals.	Gals.	Gals.	Cwt.	Cwt.
1887-88 (5 years) . .	216,826	*	216,826	6,456	266,925	273,381	54,676	271,502
1891-92 (4 years) . .	597,657	‡62,344	660,001	10,096	40,684	50,780	10,156	670,157
1895-96 (4 years) . .	447,600	67,233	514,833	1,884	320,130	322,014	64,403	579,236
During 1896-97 . .	247,185	37,600	284,785	1,632	571,860	573,492	114,698	399,483
1897-98 . .	24,579	33,954	58,533	3,049	511,614	514,663	102,932	161,465
1898-99 . .	10,296	17,316	27,612	11,305	507,249	518,554	103,711	131,323

* Not separately recorded.
† At the rate of 1 cwt. to 5 gallons of oil.
‡ For 1891-92 only.

The produce of the crops shown during the seasons of 1895, 1896 and 1897 would, for the most part, have been dealt with during the official years 1896-97, 1897-98 and 1898-99, respectively. It has already been shown that the larger exports of oil during recent years have been due to a transfer of the trade from Pondicherry to Madras ports since 1894. It is, therefore, very evident that the yield of the crop sown in 1895 was very deficient. In 1896, the season was very unfavourable during the earlier months of the sowing season; the prices of food-grains rose to famine rates almost throughout the country, and the yield of the ground-nut crops of that year and the next was still smaller.

Area under cultivation.

In the year 1889-90 the area of land sown with ground-nuts in Government and Inam villages was 279,355 acres, besides an unknown area in Zemindaries. The area had greatly increased in the previous year, having averaged only 150,550 acres during the four years ending in 1887-88. In the next four years, the average area sown was 237,725 acres, and in the four years ending in 1895-96 was only slightly smaller, *viz.*, 236,050 acres. Up to 1895-96, the

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CULTIVATION

areas sown showed no more than the usual fluctuation due to variations in the character of the season. Particulars of the areas sown in each of the last ten years for which figures are now available are given below :—

Districts.	1888-89.	1889-90.	1890-91.	1891-92.	1892-93.	1893-94.	1894-95.	1895-96.	1896-97.	1897-98.
	Hundreds of acres.									
South Arcot . . .	131,5	185,9	152,9	120,6	138,7	148,9	133,1	142,1	88,4	52,1
Tanjore	26,1	31,5	34,4	30,2	30,2	33,3	29,4	33,5	22,4	14,4
Trichinopoly . . .	14,9	16,4	15,2	11,7	10,9	10,3	17,4	19,3	10,4	5,3
North Arcot . . .	24,7	25,9	32,3	22,9	24,1	31,3	24,3	26,3	21,7	13,8
Chingleput . . .	11,6	15,2	18,9	12,8	16,8	20,1	17,9	15,5	10,0	5,6
Other Districts . .	3,1	4,5	4,6	3,1	6,2	3,9	4,0	6,7	4,4	5,3
TOTAL .	211,9	279,4	258,3	201,3	226,9	247,8	226,1	243,4	157,3	94,5

Decrease.

The decrease, as is natural, is most marked in the case of the South Arcot district in which the cultivation of this crop was first commenced on a large scale, and where nearly 60 per cent. of the total area sown was to be found prior to 1896. In the adjoining districts, though large, the falling off, except in Chingleput, has not been so great proportionately.

The falling off in the area sown did not appear until 1896-97, when it amounted to one-third on the average of previous years and the produce from that crop would for the most part be exported in 1897-98; whilst in the latter year the area sown had decreased by 60 per cent. on the earlier average, or to an area smaller than had been reported in any year since 1883-84. It is evident, therefore, that some cause has been at work other than the mere restriction of area and the unfavourable character of the seasons to bring about the decrease in exportable surplus.

Correspondence with Madras Chamber of Commerce.

Early in 1898, the Chamber of Commerce, Madras, addressed the Government on the subject as follows :—

"It has lately been brought to the notice of this Chamber that the Pondicherry Government, alarmed at the deterioration in the ground-nut crop around Pondicherry, which has gradually manifested itself during the last few years, has decided to import from West and East Africa a stock of new seeds for distribution and sale

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OUTTURN.

to local ryots, as it has been found on enquiry that the chief cause of the decrease in outturn is due to deterioration in the quality of the local seed now being sown. It has been noticed, for instance, that fields sown with seeds produced in this country have yielded a very poor crop, while other neighbouring fields sown with seeds imported from the coast of Mozambique have produced a highly satisfactory crop. This Chamber agrees with the Pondicherry Government and also with the Pondicherry Chamber of Commerce in thinking that this bad outturn is mainly, if not entirely, due to the deteriorated and poor quality of the local seed, and as the ground-nut crop has been and still is regarded as a very important one in several districts in the Madras Presidency, the Chamber considers that the example of the Pondicherry Government might advantageously be followed by the Government of Madras.

"The decrease is most noticeable in South Arcot district, and it is in that district that the effects of the deterioration of seed has been most marked. The Chamber cannot but think that the matter is one that calls for the earnest consideration of Government and for such sympathetic action as may be deemed possible on the lines followed by the French Administration."

Explanation of diminished yield.

Enquiry and consideration of the facts of the case led to the conclusion that there was nothing strange in the recorded falling-off in the yield of the crop in face of the common practice of growing the crop on the same land year after year with little or no manure,* and that it might be doubted whether the introduction of new seed could restore good crops to an exhausted soil. On this point the following quotation from Farmer's Bulletin No. 25, of the United States Agricultural Department (referring to the ground-nut crop chiefly in Virginia, North Carolina and Tennessee), is instructive:—

"Within the last few years this crop has ceased to be as profitable as heretofore. The method of culture—the annual planting of nuts on the same land, the lack of proper rotation of crops, the

* When the enquiry, recorded in Madras Bulletin No. 28, was begun, special attention was drawn to the possibility that the prevailing practice might have led to a decrease in productiveness, and the result negatived the idea. It was also made a matter for enquiry then, in 1892, whether any disease or diseases similar to the clover-sickness of Europe had appeared; but this also was answered in the negative.—*C. B.*

CULTIVATION IN THE U. S. A.

complete removal of all the vegetation from the land, and the failu to replenish the soil by means of fertilizers—has been a great fact in reducing the profits of the crop by reducing the ability of th land to produce such crops as were previously secured in that sectio so that now instead of an average of 50 bushels per acre, wit frequent yields of over 100 bushels, the average in the pea-nu section is not over 20 bushels, while the cost of cultivation has bee but slightly reduced."

The conclusion arrived at, that bad farming was the root of th evil, was also held by **Sir W. T. Thiselton Dyer, K.C.M.G.,** wh remarked that—

Opinion of the Director, Royal Gardens, Kew.

"I may say at once that deterioration of seed is a facile theor which is continually advanced when the produce of a crop is dis appointing. It is one in which I have very little belief. The rea explanation of the falling-off is to be found usually in the exhaustio of some constituent of the soil."

He added: "It is not improbable that want of potash is the caus of the diminished yield, if the diminution be a fact. Manurin with wood-ashes would be a simple means of testing this."

Saidapet Farm. Note by the Manager.

In a recent note on the subject prepared by **M. R. Ry. C. Krishn Menon,** Manager of the College Farm at Saidapet, he observes tha "Ground-nut cultivation in South Arcot came into prominence withi last 30 years. Experienced ryots who were questioned on the sub ject were of opinion that there have been three distinct periods i the history of ground-nut cultivation in South Arcot. There wa the first ten years' period of great prosperity, a second ten years diminished yield and occasional depression,* and the last ten yea of intense depression, of which last five years have been the ver worst.

The ground-nut formerly a garden crop.

"An important feature in the early history of ground-nut cultiva tion has been the fact that ground-nut was cultivated as a garde crop under well irrigation. It should be noted that in garden cult vation the land is invariably well manured and well tilled whatev the crops might be; and ground-nut was no exception. The rap development of ground-nut trade with Marseilles made Pondicher and Panruti centres of great activity. The merchants of Pondicher

* *Vide* note on previous page. The assertions are far too general, ar are not supported by fact.—*C. B.*

DEVELOPMENT OF THE TRADE

received large advances from the Marseilles merchants under what is known in commercial circles as the 'Forward sale' by which the speculators in ground-nut trade were able to advance money to the cultivators even before a single seed was put into the land. This encouraged the ryots in extending the cultivation to the dry lands rich or poor. The area taken up by an ordinary ryot was more than what he could adequately manage. At first there was heavy yield; but the facility for obtaining money induced the ryots to adopt a system of exhaustive cultivation. Ground-nuts and cumbu, cumbu and ground-nuts were the only crops. These were during the second period when depression began to be felt. Then the exhaustion of the soil told heavily on the crops of the third period. Diseases, that were unknown in the early stages, appeared on the ground-nut crop and did great havoc. Messrs. Parry & Co., who were greatly interested in the ground-nut trade, took up the question seriously and thought that by the introduction of foreign seed the industry might be revived. Accordingly five years ago they introduced the Mauritius variety which showed good results in the first year of its cultivation. The ryots eagerly took to the Mauritius ground-nut and gave up entirely* the indigenous variety. But owing to the exhausted condition of the soil, diseases soon appeared and the harvests for the last three years have been very bad. Last year a great portion of the area under ground-nut was seriously affected by pests of various sorts.

Speculators.

Crops at first abundant fell off.

Disease.

Foreign seed introduced.

With small success.

" The point raised by Sir W. T. Thiselton Dyer, that the decline in the ground-nut industry is due to the exhaustion of the soil was fully established from the ryot's own standpoint by the statements given above. Messrs. Simson & Co. practically suggest† two methods : (1) the introduction of foreign seeds, and (2) the application of special manures. The introduction of foreign seeds is always desirable, but there is a danger of the exotic seed becoming degenerated in a short time when placed in an exhausted soil. This has been fully proved by the ground-nut industry in South Arcot where in the majority of cases, for the last three years the variety grown was Mauritius, but which suffered equally or even worse than

Opinion of Kew confirmed.

Suggestions for improving the crop.

Objections.

* This statement is much too sweeping, though Mauritius (Mozambique) seed has of late years been sown widely.—*C. B.*

† *Vide* page 14.

GOOD EFFECTS OF LIME AS MANURE.

the indigenous variety. Last year the Mauritius ground-nut obtained from Panruti through Messrs. Parry & Co. was cultivated at the farm and was subject to pests that were common in the South Arcot district. Some of the most destructive of these pests were unknown at the farm. The inference to be drawn is that the seed, at any rate in some cases, has the germ of the disease in it.

"The good results obtained by the application of lime in the year 1876 have been confirmed * by the repeated good harvests obtained during the last 12 years; of course there has been very bad outturn at times but this was due entirely to the season. It has been noticed that the application of lime to a diseased crop of ground-nut enables it to throw off the disease. Potash does not seem to play an important part; for, the farm soil is extremely deficient in potash and no ash is applied as manure."

Potash not essential.

Mr. R. S. Thorne, the Acting Principal of the College of Agriculture, Saidapet, in forwarding the above note made the following remarks :—

Views of Principal, Saidapet College of Agriculture.

"In the first place, I notice that the crop has been grown year after year on the same land without even the adoption of a short rotation of cropping. The yield at first was very good, but has been gradually reducing until now the yield is practically unremunerative. The causes adduced are (1) degeneration of the plants' vitality owing to reduced size in seeds; (2) the attacks of insects and probably fungi.

"This is precisely what might be expected, and is usual in the growth of many kinds of crops without a rotation, but more particularly in the case of LEGUMINOSÆ. Clover-sickness, bean-sickness, and pea-sickness are all too well known to the British farmer; all being directly caused by pests, either of fungi or insects; clover-sickness, being caused by several varieties of mildew or by nematodes (thread worms), but all are induced by frequent cultivation on the same land. The explanation is that the frequent growth of the same species of

* The experiment made in 1876, which is referred to, showed that at Saidapet an application of lime to ground-nuts caused a considerable increase in the yield—*vide* page 145 below. The experiment was, however, made on so small a scale as to render it useless to place the actual figures on record. It is to be regretted that no data in support of the present Farm Manager's statement are forthcoming.—*C. B.*

NOTE BY MR. THORNE.

plant on a particular plot makes an ideal breeding ground for particular species of fungi and insects, both of which have constant, or almost constant, supplies of its favourite food. Though manures, especially mineral manures, have been found to increase the yield on application to the crop when first grown on a particular plot they have proved almost useless as a preventative in the English forms of the disease (*vide* Rothamstead Reports). If ground-nut disease has any connection with the diseases of its allies in Great Britain, it might be expected that when even seed from an infected area is sown in a fresh locality the plants will be comparatively healthy. This appears to be the case from the data at my disposal. For instance, seeds imported into Japan from this country produced healthy crops in that country, whilst the seed recently imported from that country is very much larger than specimens from a similar stock grown on the farm which recently has suffered somewhat from disease. Further, one of the students of the College imported some of the farm seeds into the Godavari district, the crop from which is three months old and looking very thriving."

It has also been suggested that other than agricultural causes have been in part responsible for the falling-off in the export trade from this Presidency, as the decline has not been peculiar to Madras but has affected the trade from the whole of India. Mr. O'Conor's Trade Reviews, published by the Government of India, give the figures for the exports of 'earth-nuts' from all Indian ports, and these are compared below with the figures for the Madras export trade in thousands of hundredweights :—

	All India.	Madras.
1892-93	1,525	364
1893-94	1,537	436
1894-95	2,267	669
1895-96	1,118	321
1896-97	486	247
1897-98	45	25

These figures are significant, and Mr. O'Conor suggested* that the remarkable decline was probably due to the fact that the soap-makers

* This was in his review for the year ending 31st March 1897. In his latest review he says that "the trade in earth-nuts, which but recently seemed full of promise, has practically ceased for the last two years ; the combination of disease and bad seasons having caused the crops to fail miserably in Madras, and be extremely bad in Bombay."

ARACHIS hypogæa.

MADRAS.

Chamber of Commerce.

The Ground-nut.

had found the cheap cotton-seed oils of America an efficient substitute for ground-nut oil. To this view, the Chamber of Commerce, Madras, took exception and stated, under date 3rd October 1898, that "in a letter received by the last mail from Marseilles by a local firm which is interested, and has had great experience in the trade, it is stated: 'Here our soap-boiling industry awaits with impatience the moment when ground-nut oil shall again be procurable, for the reason that cotton-seed oil cannot really furnish a good quality soap—a fact that experience confirms daily.' Under the circumstances here stated, it is impossible to believe that the competition of cotton-seed oil has had anything to do with the decrease in the ground-nut trade of Madras. In fact, the Chamber has reason to believe that there has all along been a keen competition for all the nuts produced. Indeed, at present, there is a large demand and at comparatively high prices in spite of any competition of cotton-seed oil."

In this connection, the following report by Mr. J. W. Mollison, M.R.A.C., Deputy Director of Agriculture, Bombay, recently communicated to this department, is of interest. It is quite possible that in Madras, as in Bombay, the local consumption of ground-nut oil has been materially larger of late years than formerly. Madras and Bombay are the only provinces exporting ground-nuts. Mr. Mollison, writing on 29th July 1899, stated as follows:—

"I am unable to give any definite cause for the decline of ground-nut cultivation in the Presidency.

"The area figures for ten years ending 1897-98* do not for the first nine years show any great extent of variation except that the 1893-94, 1894-95 and 1895-96 areas were abnormally high. In 1896-97 (the famine year), the area was full average as compared with the

* *Acreage under Ground-nuts for ten years ending 1897 compiled from the Annual Reports of the Bombay Agricultural Department.*

Year.	Acres.
1888-89	132,338
1889-90	141,249
1890-91	138,108
1891-92	145,468
1892-93	142,459
1893-94	184,622
1894-95	159,226
1895-96	164,627
1896-97	148,859
1897-98	98,446

ARACHIS hypogæa.

BOMBAY.

Report by Mr. Mollison.

preceding ten years. The Bombay crop is sown mostly in June and July. In the famine year there was no great deficiency of rain at sowing time. Therefore the area figures were not naturally affected. The crop, however, in common with other *kharif* crops, was more or less a failure, particularly in Sholapur and Satara, where it is grown extensively without any irrigation. In the following year there was an abrupt fall in area. This is attributable chiefly to the substitution of food-grain crops owing to the scarcity of grain and especially of fodder induced by famine. Other less important causes had also some influence; for instance, scarcity of seed and deficient rainfall early in the *kharif* season in Satara and Sholapur (the most important ground-nut districts). Canal and well water was at the same time scanty.

"Your forecast, dated January 1899, shows a further remarkable decline in area which I am quite unable to explain, if the figures are approximate to actual. The figures may, however, have to be modified as in the previous year, the January 1898 forecast being 65,000 acres and actual 98,000.

"The Madras papers show that the officers consulted are generally of opinion that the area and outturn of the crop of that Presidency have declined owing to deterioration of seed, inferiority of cultivation, and want of rotation. I do not think that the same conclusions can be substantiated in respect of the Bombay crop.

"In Satara and Sholapur the crop is to a considerable extent grown as a purely dry crop. In these districts some damage by disease is reported from time to time. In other districts, it is not generally dependent upon rainfall only. Canal or well water is usually available if required and generally the crop gets one or two or several waterings depending upon the character of the season. In most parts of the Presidency, the cultivation of ground-nuts may be taken as an indication that the cultivator is well-to-do and also a good farmer. A poor crop especially on mixed black soil can only be grown at a loss; the cost of harvesting the crop by hand-digging being very high. A poor crop costs practically just as much to harvest as a good one. Ground-nut is recognized as an extremely good rotation crop, and for this reason as also because it is directly profitable, is extensively grown on highly assessed garden land. In parts of the Poona district it is a favorite rotation crop with onions, garlic, potatoes and irrigated wheat, and is generally

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BOMBAY.

Report by Mr. Mollison.

The Ground-nut.

heavily manured by preference by folding sheep or goats on the land in the fair season. The crop is similarly grown on the highly assessed garden lands near Surat, ginger, turmeric, yams, surans, onions, potatoes, cabbages, etc., being grown more or less in rotation in the same land. I have seen no want of vigour and no indications of disease in crops cultivated in this way and with liberal treatment the crop is unquestionably profitable. On the Poona Government Farm, small plots of ground-nut with similar plots of many other common crops are annually grown as object lessons for agricultural students. The ground-nut with fairly liberal management always thrives. The seed sown is obtained from the bazaar. I do not think, therefore, that any positive deterioration in the seed of the Bombay crop can be proved. There is, however, perhaps good reason to join issue with the Madras Agricultural Department and test on Government Farms whether imported seed of the better varieties give better results than indigenous seed. I should, however, do this in the first instance on a small scale. I would consider it very injudicious to directly import seed for cultivators until the results of experimental trials are known.

"Pigs and rats are destructive pests where ground-nut is grown, and when numerous, restrict areas to a considerable extent.

"The following statement shows imports into and exports from Bombay port, for ten years ending 1897-98 :—

Year.	Imports			
	By rail from		By Coast.	Total.
	Internal blocks.	External blocks.		
1	2	3	4	5
	Cwt.	Cwt.	Cwt.	Cwt.
1888-89 .	318,686	459	Not available.	319,145
1889-90 .	455,069	676		455,745
1890-91 .	654,145	4,261		658,406
1891-92 .	666,387	4,932		671,319
1892-93 .	881,333	8,098	294,033	1,183,464
1893-94 .	1,070,484	4,311	313,518	1,388,313
1894-95 .	1,207,740	4,304	266,473	1,478,517
1895-96 .	620,337	13,036	161,739	795,102
1896-97 .	248,821	1,043	23,679	273,543
1897-98 .	59,321	646	10,802	70,769

The Ground-nut. (*C. Benson.*)

ARACHIS hypogæa.

BOMBAY.

Report by Mr. Mollison.

Year.	Exports of Ground-nuts					Exports of Ground-nut oil = nuts.*			Total Exports.
	By rail to		To Indian ports.	To foreign ports.	Total.	To Indian port	To foreign ports.	Total.	
	Internal blocks.	External blocks.							
	6	7	8	9	10	11	12	13	14
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1888-89	2,660	40	Not available.	441,312	444,012	...	...	...	444,012
1889-90	1,799	107		692,553	694,459	...	...	...	694,459
1890-91	1,638	49		707,768	709,455	36	...	36	709,491
1891-92	1,104	87		1,041,987	1,043,178	362	...	362	1,043,540
1892-93	1,279	60	23,396	1,160,477	1,185,212	...	90	90	1,185,302
1893-94	1,444	120	27,313	1,098,419	1,127,296	16	1,080	1,096	1,128,392
1894-95	1,409	197	32,908	1,598,387	1,632,901	253	101	354	1,633,255
1895-96	678	241	23,258	796,968	821,145	2,592	4,065	6,657	827,802
1896-97	1,279	99	21,489	238,795	261,662	...	5,673	5,673	267,335
1897-98	3,170	216	18,244	19,945	41,575	...	3,547	3,547	45,122

* At the rate of 1 cwt. to 5 gallons of oil.

"The imports and exports depend chiefly upon the Presidency crop. Imports either by coast or by rail from external blocks have always been trivial. It is difficult to understand the remarkable drop in 1895-96, unless the crop of that year was a particularly poor one, the area having been above average. It is of course difficult to say what proportion of the 1895-96 crop was actually moved by rail or coast during the year. A proportion of this trade movement no doubt belonged to the 1894-95 crop. Certainly all movements between June and November 1895 would be of this class.

"The smallness of imports into and exports from Bombay port in the famine year 1896-97 are easy to understand and the still smaller figures of 1897-98 can readily be explained. In 1896-97 the area under various oil-seeds shrank by 871,000 or 42·5 per cent, and the crop was poor. Oil as an article of diet, is largely used by all classes of natives, the supply being obtained from oil-seed crushed in the country *ghani*. The sweet oil of the bazaar is got to a certain extent from safflower, til and ground-nut crushed together; and following the failure of the 1896-97 oil-seed crop it is easy to understand that there would be a full local demand for ground-nut,

til, niger-seed, and safflower in 1897-98, and therefore in that year very little would be available for export. I attribute the small 1897-98 figures to this cause. I know as a fact that the Peer Mahomed Mills in Bombay and probably other oil-pressing mills were not working during a considerable period in 1897-98 owing to the impossibility of getting oil-seed. The Peer Mahomed Mill works chiefly with safflower, niger-seed and ground-nut, and produces mixed oil and mixed cake therefrom, and works usually at all seasons with these oil-seeds and with linseed, mowhra and castor-seed at special seasons.

"Prices have not dropped during the last five years. With scarcity they have risen. Any diminution in area or of outturn cannot, therefore, be attributed to a fall in prices."

Writing in April 1899 on the question of the decreased supply of ground-nuts, Messrs. Simson & Co., 31, Fenchurch Street, London, E.C., who had been largely interested in the trade in ground-nut kernels from the Madras Presidency since its inauguration, suggested that—

"(1) The gradual failure of the crops is attributable to the exhaustion of the soil.

"(2) Doubtless the Mauritius or Mozambique seed nuts, which have been recently supplied to the ryots, have shown a stronger growth than the indigenous kind, but they have not given a proper yield, and cannot do so unless something is returned to the soil for what has been taken out of it in the course of many years. Not even the ground-nut cake has been put back into the land, but has always been sold by the ryots.

"(3) If a proper fertilizer were used, the soil in the ground-nut-growing districts, which is too poor to be used for anything else, would again become productive, and enrich both the ryots and Government.

"(4) For the purpose mentioned in paragraph 2 we beg to suggest that samples of the soils, drawn from various districts in which ground-nuts are grown, be carefully examined, either at the Government Botanical Laboratory,* or that they be sent to an expert here, in order to determine what fertilizer, or fertilizers, would ensure a good yield for the future.

* It is not quite clear what is meant here, the questions suggested appearing to be mainly chemical and not botanical.—*C. B.*

The Ground-nut. *(C. Benson.)*

ARACHIS hypogæa.

MADRAS.

Chamber of Commerce.

"(5) The best fertilizers being determined upon, we would suggest that the same be put on to a small tract of land in each district; that on the land so prepared and on an equal area alongside of it *not fertilized*, ground-nuts be sown. The result should convince the ryots of the advantage of using fertilizing material, and of the profits they may derive from so doing."

The Chamber of Commerce, Madras, who had been favoured with a copy of the letter quoted above, having regard to the importance of the industry, expressed a hope that Government would forward samples of soils to **Sir W. T. Thiselton Dyer**, with a view to his submitting them to an expert for an expression of opinion as to what fertilizer or fertilizers should be applied to the several soils in order to produce better yields of kernels, remarking that he had already expressed the opinion that he has "very little belief" in the theory that deterioration of seed causes a falling-off in the crop, and that "the real explanation of the falling-off is to be found in the exhaustion of some constituent of the soil:" and that though he referred briefly to what constituent may be wanting the Chamber desired to obtain his matured and detailed opinion on the subject.

This led to **Dr. Leather**, Agricultural Chemist to the Government of India, being consulted on this point, as he had already analysed certain soils from the South Arcot district believed to be fairly typical ground-nut soils. The soils were—

No. 381 from field No. 287, Nanjalur, Chidambaram taluk.
„ 382 „ „ 103, Tiruppapuliyur, Cuddalore taluk.
„ 383 „ „ 32-B, } Karaiemettakuppam, Cuddalore
„ 384 „ „ 272-A, } taluk.
„ 385 „ „ 408-C, Pannikkuppam, Cuddalore taluk.
„ 386 „ „ 440-E, Villupuram, Villupuram taluk.

The enquiry addressed to **Dr. Leather** elicited the following reply, dated 29th June 1899:—

"With reference to the question I have the honour to say that of the soils named they are all very deficient in lime; four of the six (Nos. 381, 382, 385, 386) contain too little phosphate; five (Nos. 381, 382, 383, 384, 385) contain very low proportions of nitrogen, as is so common in Indian soils; only one (No. 382) appears to be in any need of potash.

ARACHIS hypogæa.

The Ground-nut.

DR. LEATHER'S REPORT.

"These remarks are made from a *general* standpoint. Unfortunately we have but little information regarding the ground-nut crop in particular. In my opinion, the most practical way of testing the manure question would be to apply some finely ground or partly dissolved phosphates alone, say, about 5 cwt. per acre; secondly, as liberal a dressing of lime as may seem to be economically practical, say, about 2 or 3 tons; thirdly, the two combined; fourthly, a manuring with either cattle manure or its equivalent of some oil-cake such as castor bean."

In order to elucidate the report, a table of the results of Dr. Leather's analyses as given in *Agricultural Ledger* No. 2 of 1898 is given below together with a summary of the notes made by the Sub-Assistant Director of Agriculture regarding the soils in question. That officer selected the samples, and most of the information on record regarding the crop was collected by him (*vide* Bulletin No. 28).

Analyses of Ground-nut Soils from the South Arcot District—Madras.

	No. 381.	No. 382.	No. 383.	No. 384.	No. 385.	No. 386.
Insoluble silicates and sand	82·33	95·04	87·61	77·09	96·01	93·71
Iron (Fe^2O^3)	4·84	2·05	3·46	8·27	1·65	2·68
Alumina (Al^2O^3)	5·85	1·06	3·89	10·60	0·90	1·12
Manganese (MnO)	0·09	0·04	0·06	0·05	0·03	0·04
Lime (CaO)	0·32	0·15	0·10	0·05	0·09	0·18
Magnesia (MgO)	1·04	0·51	0·26	0·21	0·20	0·33
Potash (K^2O)	0·98	0·03	0·11	0·10	0·07	0·09
Soda (Na^2O)			0·16	0·06		
Phosphoric acid (P^2O^5)	0·06	0·03	0·10	0·14	0·04	0·04
Carbonic acid (CO_2)	0·06	0·13	0·09	0·09	0·14	0·09
Organic matter and combined water	4·43	0·96	4·16	3·34	0·87	1·72
TOTAL	100·00	100·00	100·00	100·00	100·00	100·00
Nitrogen	0·017	0·010	0·009	0·008	0·023	0·19

The Ground-nut. (*C. Benson.*)

ARACHIS hypogæa.

ANALYSES BY DR. LEATHER.

No. 381—Tam. *palpottai*, produces good crops of ground-nuts.

„ 382—Fertile.

„ 383—Had been liberally manured with ashes and silt; almost continuously cropped with ground-nuts.

No. 384—Less fertile than No. 383 and taken up comparatively recently.

No. 385—Had been manured as No. 383, and cropped incessantly with ground-nuts and cumbu.

No. 386—Had been manured and cropped as No. 383.

Further local enquiry showed that soil No. 382 is not a typical soil in any part of the South Arcot district, and therefore a deficiency in potash is probably not the weak point of the ground-nut soils of South Arcot. Possibly if there ever was such a deficiency it is met by the heavy dressings of ashes which are applied in many cases by the ryots. In regard to the deficiency in lime alluded to by **Dr. Leather**, it is worth mention that in an experiment made on the Government Farm at Saidapet in 1876, an application of lime there caused an increase of 83 per cent. in the yield of nuts.

In his letter above quoted **Dr. Leather** added—

"**Sir W. T. Thiselton Dyer** refers * to the proportion of oil in Madras ground-nuts and quotes figures showing it to be the poorest quality of nut in the market. I think it would be a good plan to have a number of samples analysed this season, because the information on this point (as indeed it is in the case of nearly all Indian crops) is *most* meagre. The only sample of ground-nut which I have analysed in India contained 49 per cent. oil, which is very high!"

Arrangements are being made to carry out this suggestion.

* The remarks alluded to were as follow :—

"Madras ground-nuts have long been known to be the poorest in quality of any to be found in commerce. The percentage of oil in shelled kernels is given in the above report † as follows :—

Senegal	51
East African	49
American	42
Madras	43

"From these figures it does not appear that any advantage would arise from introducing American seed. As to Japan ground-nuts, I have no information. The oil from American seed again appears to command an inferior price to that from African."

This does not at all accord with data published by authority in America. The amount of oil in different varieties varies considerably and on this point, the percentages noted below from Farmer's Bulletin No. 25 of the United States Department of Agriculture are instructive.

† United States Consular Report for April 1894.

ARACHIS hypogæa.

FARMER'S BULLETIN, U. S. A.

The Ground-nut.

This Bulletin was published a year later than the Consular report quoted by Sir W. T. Thiselton Dyer:—

Alabama	55·37	per cent. of fat.
Tennessee (two crops)	48·98	ditto.
Georgia	43·13	ditto.
Spanish (grown in Georgia)	41·17	ditto.
Egyptian	52·30	ditto.
Bombay	50·47	ditto.
Congo	52·88	ditto.
African (Rufisque)	52·48	ditto.
Japanese (two sorts)	54·57	ditto.

Sir W. T. Thiselton Dyer in another communication quoted the following extract from the United States Consular reports for December 1898 regarding the utilisation of the product in France, which is interesting:—

"*Pea-nuts.*—This nut, so common in the United States, is very rarely eaten roasted in France, and nearly all that enter the port of Bordeaux are imported from Spain, Italy and Africa. The variety is small and uninviting-looking and exorbitantly high, the price being about three times that asked in America. The taste for these nuts as a food is growing; it is practically certain that if the fine American varieties were put upon this market at a reasonable price, they would find a ready sale.

"Many tons of pea-nuts are imported from the west cost of Africa, India and Malayan Archipelago and are sold in Marseilles and other European countries; these are principally for the oil, which is extracted from them. Pea-nut oil is used for cooking purposes and as an adulterant and substitute for olive oil."

A. 1261-72.

G. I. C. P. O.—No. 2062 R. & A.—3-5-1900.—2,230.—J. W. G.

(Mineral and Metallic Series, No. 13.)

THE AGRICULTURAL LEDGER.

1900—No. 2.

MICA.

[*Dictionary of Economic Products, Vol. V.*, M. 509-13.]

On SAMPLES of MICA from JAIPUR.

A Report by PROFESSOR WYNDHAM R. DUNSTAN, F.R.S., *Director of the Scientific and Technical Department of the Imperial Institute. With an Introduction by* THE EDITOR.

The information given below was, on receipt of Professor Dunstan's report, reserved with the intention of being published in the Review of Mineral Production in India. The Government of India having subsequently, however, decided that that Review should in future appear every fifth year, and that the annual issue should be replaced by a yearly statement showing figures of production only, Professor Dunstan's useful report is accordingly published in *The Agricultural Ledger*.

The circumstances under which the report was obtained were briefly these :—

In 1898 the Resident at Jaipur forwarded to the Reporter on Economic Products for favour of opinion as to quality, etc., samples of Mica produced in the Kishengarh State. These were accompanied by the following letter from the Dewan of the State :— Reg. No. 1153.

"I beg to send herewith samples of the Mica that is to be found in this State in abundance."

"I shall esteem it a favour if you will kindly forward it to the Reporter on Economic Products to the Government of India with a view to seeking his advice as to the market value of mica of this sort and the means of developing the industry."

MICA. | **On Samples of Mica from Jaipur.**

KISHENGARH STATE.

"The mica Mines that abound in Behar turn out mica of superior quality, but the inferior qualities of mica from these mine also find a market. I fancy our mica will at least be found to be a good as the mica of Behar, and even as such I hope it will prov remunerative."

"I have been trying to find out if a market could be found fo this mica, but have not been able to discover proper persons for th business."

The samples of mica in question were in due course forwarded to the Honorary Secretary and Director, Imperial Institute, London with the request that he would favour this office with expert's opinion as to quality and to commercial value in London.

Sir Frederick Abel, Bart., K.C.B., courteously responded by forwarding the following report by Professor Dunstan, F.R.S., on the commercial valuation of the samples.

PROFESSOR DUNSTAN'S REPORT.

Report on Samples of Mica from Jaipur by Professor Wyndham R. Dunstan, F.R.S.

The samples of Mica referred to by the Officiating Reporter on Economic Products to the Government of India in his letter No. 2946—184 F. S., dated the 8th November 1898, which enclosed a letter from the Resident of Jaipur requesting a report on the value of the mica found in that district, have been examined. The mica experts report that the samples are quite worthless, their chief defect being that they are striated, or cross-grained, and much cracked; this kind of mica is only adapted for electrical purpos es.

Behar yields clear "ruby" mica." At Jaipur mica would probably work out better at a greater depth from the surface.

The Dewan of Kishengarh is mistaken in supposing that this mica is similar to the mica of Behar, since the product derived from that district is the fine clear "ruby mica" which is so largely employed for the construction of chimneys for stoves and lamps. The samples of Jaipur mica appear to have been taken from the surface outcrop, and the experts consider that it is quite likely that, if properly mined, better samples could be obtained. In order to furnish the authorities in Jaipur with precise information as to the characters of the best quality of black-spotted mica, I send herewith a number of specimens of the material, which command the best prices in the English market.

On Samples of Mica from Jaipur. (*W. R. Dunstan.*) **MICA.**

PROFESSOR DUNSTAN'S REPORT.

It should be borne in mind that at the present time there is a very considerable supply of small spotted mica which is employed for electrical purposes. There is, however, a great demand for uncracked large plates over eight inches in length, the width being immaterial. Prices ranging up to about 12 shillings per pound have been obtained for mica plates 3 to 7 inches wide, and from 16 to 20 inches long. I also append the following general remarks on the subject of mica which have been made by our mica experts :—

Home prices.

General remarks by experts.

"Mica taken from the surface is usually decomposed and of no value, but the outturn frequently becomes more satisfactory as deeper levels are reached. There is also a great loss in weight attending mining operations, due to inferior, buckled, and cross-grained slabs, and this loss ranges generally from 50 to 90 per cent. of the outturn. Where labour is cheap the mica should be cleaned, split, and trimmed where found, and packed in boxes not exceeding 100 lbs. in weight.

Trade requirements.

"The requirements in this article are that plates or sheets should be quite flat, smooth, and of an even and uniform thickness of about $\frac{1}{8}$ inch. They should be roughly trimmed square or oblong (no plate to have more than five sides) with edges cleanly cut; plates of precise dimensions are unnecessary until the quality of the mica has been found to be suitable for its sale as 'cut mica.' It is very important that the plates should split easily, therefore all cross-grained, ridged, or buckled plates must be discarded, and all cracks or flaws carefully removed from all mica sent forward for sale. Care should also be exercised not to pack in the same case plates of mica varying more than one inch in either length or breadth.

Packing.

Colour unimportant.

"Colour is immaterial; it may be white, ruby, amber, green, black or yellow, spotted or stained; each variety is useful for different purposes, but mica of clear pale green or clear ruby colour is the most valuable.

"There is practically no sale for plates of less than two inches in width, and but little demand for plates over ten inches in width, but the plates increase in value with their length, the smallest merchantable dimension being three inches.

Minimum size of sample parcels.

"Samples sent for valuation should be at least 50 lbs. in weight."

G. I. C. P. O.—No. 2128 R. & A.—25-5-1900.—2,230.—R. N. D.

(Agricultural Series, No. 29.)
(Spices and Condiments.)

THE AGRICULTURAL LEDGER.

1900.—No. 3.

PIPER NIGRUM.

(PEPPER.)

[*Dictionary of Economic Products, Vol. VI., Pt. I.*, P. 811-20.]

CULTIVATION OF PEPPER IN THE BOMBAY PRESIDENCY.

A Note by J. W. MOLLISON, ESQ., M.R.A.C., *Deputy Director of Agriculture, Poona. To which is added an account of Manures used in Spice Gardens.*

The two useful papers, by Mr. Mollison, given in these pages, are reproduced from the *Bombay Bulletin* by the courteous permission of the Survey Commissioner and Director, Land Records and Agriculture, Bombay.

The commercial product here dealt with is the dried fruit of a vinelike plant which is found wild in the forests of Malabar and Travancore. The plant is cultivated largely in Southern India, Siam, Malaya, Cochin-China, and other tropical parts with moist hot climates. A rainfall of 100 inches or more appears to be necessary. The plant is a large climber. The leaves are glossy, acute, cordate. The flowers are pendulous spikes and the fruit red berries, the size of peas in racemes. The berries are fleshy. The pulp covers a soft stone. The plants in climbing cling by adventitious roots very closely to any support. In the Kanara gardens pepper is trained on the *supari* palm trees.

How propagated.

The plant is propagated by layering or from cuttings. The former is the preferable plan. When the betel palms have been

PIPER nigrum.

Cultivation of Pepper

PEPPER CULTIVATION.

seven or eight years permanently planted, pepper is planted at the roo of the trees. If a long healthy vine, from an established plant, ca be stretched to reach the root of the betel palm, this vine is layere in the leaf-mould manure which surrounds the roots of the palm The pepper vine takes root freely in this manure, and when it h done so, is severed from the parent plant and trained on the pal stem. Two or three vines are layered to one palm. The be months for propagating by layering or otherwise are June or Jul The young pepper plant grows rapidly. The main vine shou branch freely into subordinate vines, so that a number of vines ca be trained straight up the palm. They are fully secured to t stem by bands stripped from the sheaths of fallen leaves of th betel palm. The bands are tied about a foot apart, and in wel managed gardens are renewed annually at the top and twice a ye at the bottom, but in a young plantation a band must be put o from time to time as the vines grow. The main and subordina vines grow up the tree to a height of five feet or more per annu Luxuriant growth and free branching are encouraged by heav applications of good manure given annually for three years aft plantation. Subsequently the pepper participates in the gener cultivation given to the betel palms and an application of manu is given for both crops every second year. The manure is heape over the bared roots of the betel trees and pepper plants in a circ round the stems, and if plentiful a big basketful is given to eac betel palm, less being given if manure is scant. The basket saucer-shaped, about 3 feet in diameter and 15″—18″ deep in th centre. The best manure for pepper, betelnut, and all other crop of the garden is made from green leaves and twigs plucked pruned in the monsoon and used as litter in the byres whe buffaloes and other cattle stand, and thence removed to a dee manure pit every day or second day with the dung and urine of th cattle. This manure is sufficiently decayed by the following Marc and is applied in that month or in April. The pepper plants an established plantation rise to a height of 15 to 20 feet. Throug out their whole length they send out horizontal branches which a generally about 18″ long. The foliage in healthy plants is fro the ground upwards fairly dense, but in an established plantati some of the older vines die. Then the foliage becomes less den

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PEPPER CULTIVATION.

unless the plants are renewed by new layers. A plantation is in bearing three or four years after it is started, and if the old vines as they get worn out are at once replaced by new layers, the plantation should keep in vigorous growth and bearing for a long period. The flowers appear in July and August and the berries are ripe in March. The yield depends upon liberality in manuring and careful management, also upon the rainfall. The rainfalls of June and July are important as these cause the plants to produce many flowers, but if the rains come in heavy downpours subsequently the inflorescence may be destroyed before it fairly sets. If there is a long break after the first rains the flowers may wither. With light showers, however, a full crop may be expected.

Its yield.

The vines on one palm when in full bearing yield in a good season about 1,000 clusters on an average. The clusters vary in size; but 1,000 should yield about 7 seers of dried pepper (a seer* = 24 tolas).

The plants, the flowers, and the fruit are delicate in the sense that they are damaged by rough handling. Therefore ladders are used when the vines are bound to the palms and the berries plucked. The ladders are straight single bamboos, with the alternate side branches cut off about a foot from the stem. These provide the steps of the ladder. A wooden hook is rigidly attached at the top end of the ladder and secures it to the palm above the level of the tallest pepper plants. The ladder is slightly inclined in a certain direction when in proper position and then can be safely used as it cannot well slip.

How plucked.

The bunches are plucked by hand and placed in an oblong cane basket slung horizontally behind the workman by a rope round his waist. The rounded ends of the basket project a little on either side so that the basket can be conveniently filled by either hand of the workman. When plucked all the berries in a bunch may be equally and fully ripe, but ordinarily the bunches are plucked when the berries are mostly green and just changing in colour. The berries may or may not be sorted as they are plucked. If they are sorted those fully ripe are separated. These are soaked in water for seven or eight days or heaped, so that the pulp ferments and then rubbed by hand or on a coarse cloth if

* 1 Bombay seer = ·7lb.

PEPPER CULTIVATION.

the quantity is small or trampled under the feet of coolies if large. The pulp is thus rubbed off the inner "stone." The stone furnishes the white pepper of commerce. The pulp is completely removed by washing in baskets in running water. The pepper is then dried by exposure to the sun for about a week. This has also a bleaching effect, and the pepper becomes pale-grey or pale-drab in colour. It can be bleached a whiter colour by chemical agency. This white pepper is only prepared to a limited extent in the Kánara forests. The chief product is black pepper. It is got from unsorted berries which are heaped up for four days. The green berries then get softer and change colour, and the pulp of all is more or less squashed. Then the berries are spread out and dried. The skin and part of the pulp adhere as a dry, dark-coloured wrinkled covering to stones and the pepper is black in appearance. White pepper is worth R10 to 11 per maund. Black pepper is worth R7 to 8 per maund.

MANURES.

Manures used in Kanara Spice Gardens.

The owners of spice gardens in Kánara depend chiefly upon leaf-mould for manure. They have never used manure of any other description and have no faith that ordinary cow-dung manure, oil cakes, or other concentrated manures would serve their purpose equally well. They consider that the best leaf-mould manure is got from the green leaves and small succulent branches of certain trees which during the monsoon are used as litter under the feet of cattle tied during night and the greater portion of the day in sheds. This litter is freely used—five large head-loads being brought daily for about twelve cattle. The litter having absorbed the urine and dung is removed daily or every second day and put in square pits which are generally about 8 feet deep. These pits are dug in situations where they catch the whole direct rainfall, which is very heavy, and possibly also a good deal of drainage water from higher levels. The subsoil is very retentive, and there is probably not much drainage through the subsoil from the manure pits, but the contents of these pits must be continuously wet during the monsoon. For each acre of garden an owner would like to have four cattle. He owns always a milch buffalo or buffaloes, but keeps no work cattle as all the garden labour is manual. If he

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MANURES used in SPICE GARDENS.

does not own sufficient cattle, he hires them, feeding them gratis for the value of the manure produced. The hiring of cattle is a common practice. They are chiefly fed on dry grass which is of very inferior description. They probably also eat part of the litter as some of the leaves used are liked by cattle. Milch buffaloes get safflower cake or cotton seed, both imported from Hubli (Dhárwári District), and it is rather significant that the gardeners think leaf-mould got from buffalo litter is best for manure. Some owners feed cotton seed or cake to all their cattle in the monsoon, and I have no doubt they find it pays to do so, because ordinarily the cattle are, during this season, miserably thin and unhealthy. Many cattle are brought in from Dhárwár, but only survive a few seasons in the feverish climate of Kánara.

In the fair season the cattle get a good deal more freedom, still they are kept in the sheds for probably about fifteen hours in the twenty-four and the sheds are littered freely. The rough grass is supposed to be given as fodder, but is spread all over the floor in the sheds and the cattle eat only a small proportion of it. Again, at this season dry leaves are collected and also used as bedding. But the gardeners think dry fallen leaves poor stuff and discount the value of such as manure. The manure put in the pits in the hot weather has a full year to decay, the manure being used always in February and March. That which is made during the monsoon has less time to decay, and the gardeners attach particular value to the green leaves and twigs of certain trees collected during the monsoon because such decay very quickly. Such leaves are generally large and fleshy and are much more easily collected than smaller ones. A man can collect and carry to the cattle shed five head-loads per day. The leaves and branches of other trees are also held in high esteem for leaf-mould, because the manure produced has the reputation of destroying insects and grubs which would be harmful to the plants in the garden. The trees which provide leaves of the latter class have all unquestionably astringent properties, and it is perhaps reasonable to believe that vegetable matter containing astringent resins or volatile oils might destroy insect life or that insects would not be likely to harbour in such material. The gardeners assert that since they have been denied the use of the leaves of certain reserved trees grubs and borers have become destructive to their

MANURES used in SPICE GARDENS.

cardamom plants and betel palms, these insects causing damage first at the roots.

It is impossible for me to say what weight of manure is actually applied per acre. But judged by the eye, I think it is certain that the application is at least equal to a heavy dressing for ordinary garden crops. It probably approximates thirty ordinary cart-loads per acre per annum, perhaps more.

The invariable practice is to put the leaf-mould immediately over the roots round the stems. The circle would be 3 or $3\frac{1}{2}$ feet in diameter. It is urged that the leaf-mould, if unprotected, would be washed away by heavy rainfall, and this is perhaps true, and in consequence a good deal of branchwood cut green in the hot weather, so that the leaves adhere, is used to cover the leaf-mould. The branchwood which is most desirable is such as will slowly decay and has astringent properties, *i.e.*, has the power of keeping destructive insects away. The branches of *Jambe* (**Xylia dolabriformis**) and *Nelli* (**Phyllanthus Emblica**) have the two qualities referred to in a special degree. The branchwood used does not readily decay. It affords considerable protection to the leaf-mould. A year after it is applied the leaves have decayed and the branches are partly rotten, still they would break the force of heavy rain. It might be urged that a covering of soil over the leaf-mould would be sufficient protection, especially as the soil of these gardens is of a decidedly adhesive character. It is possible that this adhesiveness would tend to exclude air and moisture from the leaf-mould and prevent it serving its purpose as manure. But I do not believe such would be the case. At Bassein in the Thána district, with a rainfall as heavy as that in Kánara, the manure given is put round the roots of the plantains, betel-vines, and other crops much in the same way as at Kánara and protected by a covering of soil. The soil is, however, a light alluvial sand and the manure is not washed away. The manure used at Thána is cow-dung manure and castor-cake, chiefly the latter, and it is given in several applications every year. The question is, can a manure of this class be economically substituted for a portion at least of the very heavy and very expensive dressings of leaf-mould now applied. I consider that the leaf-mould manure is expensive, even although its production requires only labour in collection and the keeping and feeding of cattle.

MANURES used in SPICE GARDENS.

Castor-cake and safflower cakes are produced on a large scale in the Dhárwár district and are obtainable at very moderate rates by the Kánara gardeners. It might, therefore, be advisable to experiment with these manures and prove their effect.

G. I. C. P. O.—No. 2360 R. & A.—25-5-1900.—2,230.—R. N. D.

(Agricultural Series, No. 30.)
(Narcotics and Stimulants.)

THE AGRICULTURAL LEDGER.

1900—No. 4.

ARECA CATECHU.

(BETEL-NUT PALM.)

[*Dictionary of Economic Products, Vol. I.*, A. 1294-1328.]

CULTIVATION OF THE BETEL-NUT PALM IN THE BOMBAY PRESIDENCY.

A Note by J. W. MOLLISON, ESQ., M.R.A.C., *Deputy Director of Agriculture, Poona.*

The following paper is reproduced from *The Bombay Bulletin* with the kind permission of the Survey Commissioner and Director, Land Records and Agriculture, Bombay.

The reader's attention may here be directed to Mr. Mollison's useful Note on "Manures used in Kánara Spice Gardens" given in *The Agricultural Ledger* No. 3 of 1900.

Habitat.

The palm is a native of Cochin-China, Malayan peninsula and islands. It is cultivated throughout tropical India, but does not thrive at any great distance away from the sea.

Betel palms, cardamoms, and pepper are the chief crops grown in the garden lands of Kánara. In old-established gardens there may be a few jack-fruit and cocoanut trees, also plantains, limes, coffee bushes, and pineapples. These gardens are chiefly found in Sirsi and Sidádpur talukas and in the whole Collectorate extend to some 17,000 acres. They generally occupy the bottom lands of narrow valleys. The most favourable situations are in valleys which have the slopes on both sides fairly extensive, moderately steep, and covered with forest growth. The forest growth

BETEL-NUT CULTIVATION.

Garden land.

gives beneficial shade and shelter, and supplies the garden with branchwood, leaves, and litter for manure and other purposes. The garden land extends usually in a narrow strip along the course of any particular valley and is subdivided according to ownership. Bottom land which is open and cleared appears to be more suitable for rice beds than for spice gardens. Some garden occupants also own rice land, but most commonly they only cultivate garden land.

Owners.

An owner may own three or four acres, sometimes more, often less. All garden owners are Haviks—a shrewd and hardworking, well behaved class among the Bráhmins. They are supposed to have

Origin.

come originally from Mysore. Their methods of cultivation are almost identical in all gardens, and presumably are ancient in

Methods ancient but successful.

origin. The methods adopted are successful in practice, and although they appear at first sight extraordinarily antiquated to a casual onlooker, they may, like other time-honoured Indian practices, be found on full enquiry the most suitable for the existing natural conditions of the district. The Haviks are well-to-do, as evidenced by their commodious well-built houses, which in many cases are roofed with Mangalore tiles.

Location of gardens.

The narrow strips of spice gardens follow the course of the old *nálas* which drained the valleys before the gardens existed. When the gardens of any particular valley were first formed the bed of the *nála* was levelled and also the bottom land along its course. Since that time the slopes on either side have been gradually cut away and many of the old gardens are now bounded laterally by almost perpendicular cuttings 10′—20′ in height. These cuttings present a complete barrier against trespass by man or beast and shelter the gardens from storm and wind. The occupants' house and buildings are close to the garden, above the cuttings, usually in a cosy fairly dry situation. A garden is entered by descending a steep narrow pathway or by rude steps which lead to a plank-bridge over a ditch at the bottom. The

Rainfall.

rainfall of the district is heavy, and the positions of the gardens are

Drainage.

such that much drainage water must pass through them. Drainage is thoroughly arranged for by main ditches cut along the course of the garden-strips and by cross minor ditches which carry water to the main drainage channels. The main channels are bridged here and there as required by long slabs of stone or by three or four pieces

BETEL-NUT CULTIVATION.

of palm-stem placed side by side. The heavy rainfall and the flood of drainage water in the monsoon undoubtedly wash much of the garden land away, and more particularly so if the soil is not of a particular kind. The most suitable soil is called locally *kagdali*. This is a yellowish red or reddish-brown earth which usually exists in deep beds as the side cuttings of the garden show. In these cuttings rock of a soft nature sometimes obtrudes a few feet below the surface, but more often the whole depth of cutting is soil-like in character, and appears in layers which vary somewhat in consistence. There are no definite lines of demarcation between layers; but near the original surface generally there is sometimes a gritty or gravelly section which is considered inferior. Further down there is a layer which presents a shaly appearance which deceives the eye. At first sight it appears hard, durable or rocky, but a piece can easily be broken off by the hand and if squeezed or rubbed crumbles into an impalpable powder which feels moist and soapy. This soil material as seen in the cutting has a peculiar metallic lustre, but when crumbled is simply a fine argillaceous yellow earth extremely retentive of moisture and which under pressure becomes consolidated so that running water does not readily remove it. It is easy to understand that a soil of this class is suitable for a spice garden. It does not matter much whether the soil is naturally fertile or not, because the yield of the crops grown is mostly affected by the quantity and quality of manure directly applied. As regards the soil the chief point is that it must be of such consistence that it can withstand the denuding effect of flood water and be so retentive of moisture that little or no irrigation is required in the fair season. In many gardens irrigation is not required even in the hot weather. At this time a trickling stream fed from natural springs may be seen running along the main channels or a perennial *nála*- passes by the main channels through the garden. The soil is thus kept continuously moist. In such gardens ferns and mosses in great profusion and variety grow along the drainage channels. In other gardens not so favourably situated a little irrigation may be required in March, April, and May, and this is arranged for from a tank or tanks usually built of stone and not very capacious, which tap the waters of natural springs.

Soil.

Manure.

Irrigation often unnecessary.

In laying out a garden, the soil is first levelled and then the drainage channels are made. The main channels are about four feet

BETEL-NUT CULTIVATION.

Planning out a garden. *Bharan Conf. p.*

deep and four or five feet wide at the top with sides having an easy slope to the bottom. The minor cross channels are one foot wide and about 18 inches to 2 feet deep. These channels are exactly parallel. They are distant from each other 12 to 15 feet. The space between is called *bharan*. The *bharan* has a rounded surface. It is highest in the middle, thus rainwater drains freely to the channels. A pathway runs along the middle of each *bharan*, or rather by usage the middle of each *bharan* becomes a pathway. On each side of the pathway, in old-established gardens, a line of alternate betel palms and cardamoms are found with pepper plants trained on the stems of the palms. The palms are 6 to 8 feet apart in the rows. It takes, however, many years of patient labour before the garden gets to this stage. When a new garden is made the *bharans* are thoroughly dug and weeded. Plantains are planted along the water-courses. They give some direct return for expenditure incurred, but the object in

Shade tress.

planting them is to provide shade for the betel palms. When the plantains afford sufficient shade, pits $2\frac{1}{2}$ to 3 feet square and $2\frac{1}{2}$ feet deep are made. Leaf manure and pieces of plantain stem are put in the bottom of the pits and then excavated soil partly filled in. The young palm trees 4 or 5 feet high and three or four years old are planted in these pits and sufficient of the excavated earth put round and pressed on the roots to keep the plants straight.

Seed-beds.

The palms are raised in seed-beds and are once transplanted before they are planted out permanently. The first seed-bed is carefully prepared, the soil is dug, broken fine and mixed with leaf-mould. Fully matured nuts from old trees are specially selected for planting. These are planted about 9 inches apart in April. The seed-bed should be kept thoroughly moist. The shoots appear in

Transplanting.

June. The seedlings are transplanted in October into any moist place in the garden or along the water-courses about 2 feet apart and remain thus until permanently transplanted. This permanent transplantation is usually done towards the end of the rains. In the

Manuring.

following March the trees are manured with leaf manure and the manure is covered with fresh cut branchwood which is partially withered but which retains the leaves. The object of placing a layer of small branches above the manure is to break the force of heavy rain. The rain soaks through the brushwood, moistens the manure, but does not carry it away as would be the case if it were uncovered or covered with soil or in any other ordinary way.

in the Bombay Presidency. (*J. W. Mollison.*)

BETEL-NUT CULTIVATION.

Trees come into bearing in about 10 years. *Bharan Conf. p.*

The betel trees are manured as described every second year and come into bearing in ten years or so. The plantains are maintained for some years after the betel-palms are permanently planted, but in time are removed and the cardamoms are planted between the palms and on the stems of the latter pepper vines are trained.

The *bharan* gets more or less washed away during each monsoon and the channels more or less damaged. This to some extent is prevented if plantain leaves, dried grass, and other available rubbish is put on the surface. But despite any precautions, the *bharan* is more or less denuded. The earth from the pathway is, therefore, moved to repair the drainage channels, etc., and new *kagadali* earth is brought in in head-loads from the cuttings which border the gardens and placed along the centre of the *bharans*. This renewal is necessary at least every third year. It is an expensive operation, but if the excavation from the cuttings is done in a systematic manner the area of the garden can be gradually extended. The trees in the first plantation of betel palms generally stand wide apart, but as they grow other young trees are planted between them. A nursery is always maintained to provide young trees for this purpose and to replace those which die from time to time.

Its yield.

Betel trees are known to fruit freely for thirty or forty years, and there is a popular belief that they are sometimes profitable much longer. On an average each tree has two bunches of fruit, sometimes three or four. But two good bunches yield as much as three or four inferior ones. The size of the bunch depends upon the manure used and upon the rainfall. A good bunch gives 200 to 300 nuts and a specially good one about 400. With unfavourable rain or cloudy weather in April or May many of the young nuts fall off and a smaller number of nuts on each bunch reach maturity.

Season of flowering and fruiting.

The trees produce flowers in March and April and the nuts are ripe in November or December, but to some extent the trees produce flowers and fruit out of season.

Sheaths how employed.

Immediately below each bunch there is a frond or leaf. It with its sheath remains attached to the tree for about two months after the inflorescence comes. Then these leaves fall to the ground. A few additional leaves fall during the monsoon. The sheaths of the leaves are a valuable product in the garden economy. They are used to provide hoods for protecting the branches of betel-nuts from the rain. If unprotected the nuts rot.

Manner of sheltering the fruits.

Two sheaths are used to make one hood.

BETEL-NUT CULTIVATION.

Manner of sheltering the fruits.

The sheaths are skewered together to form a hood by means of thin pieces of split bamboo in a manner which is easy to demonstrate, but difficult to describe in writing. The hood is made adjustable in a very ingenious manner; and when it is bound round the bunch with thongs of plantain bast it efficiently wards off rain.

The hoods are made and tied on by professionals who come from Mysore territory and below the Ghâts. A good workman can make 250 hoods per day and is paid R2 per 1,000. This operation and tying them on costs at contract rates R10 to 12 per 1,000 bunches and two meals per day. The men do not ascend and descend each tree. When once they have climbed up, they by means of slight exertion swing the tree and deftly catch hold of another and rarely descend to the ground for hours. These expert climbers also gather the fruit by cutting the bunches from the stem, getting R4 per 1,000 bunches and three meals per day. Some garden owners or their regular servants are experts in making hoods, in adjusting them, and climbing the trees. It is extremely interesting to note the manner in which the work is done. The climbing in the fair season looks extremely simple and easy to an onlooker, but in the monsoon with falling rain the tall smooth stems are slippery and the ascending process is much more difficult. The climber first ties his feet together round the insteps with strong bands stripped from the sheath and leaves of the betel palm. This helps him to grip the stem with his feet. He carries with him slung round the neck a wooden rest on which to sit when he gets to the top. This rest is shaped like a two-armed pick, and through a hole which corresponds to the shaft hole of a pick, a rope is passed and spliced, so that it is endless. When the fruit is reached the rest is unslung and attached to the tree. The doubled end of the rope is passed round the stem and is long enough to pass over the two prongs of the rest, and when drawn tight secures the rest to the tree. It does not slip down, because the circumference of the stem increases downwards and the rings in the tree offer obstruction to sliding or slipping. The operator sits resting one thigh on each wing of the rest and one hand at least is comparatively free to fix the hood over the bunch of nuts or to sever the bunch when ripe from the stem. The bunches when ripe are lowered to the ground by being slung to a rope over which they ride. Any one who has seen a bunch of betel-nuts can easily determine how the bunches are placed on the rope. They rapidly slide down and are

How gathered.

BETEL-NUT CULTIVATION.

caught by a man who holds the end of the rope at the ground. The stretched rope is held inclined at a considerable length from the tree.

How husked.

The bunches on a tree ripen unequally. The lowest bunch first, the uppermost last. Moreover, in the same bunch some nuts may be ripe and yellow and others unripe and more or less green. The ripe nuts are much the same size and shape as small apples. The outer skin is yellow, smooth, and shining. The inner husk is very fibrous and not easily removed. The first process in preparing for market is to remove the husk. This is done very deftly by means of the *hatti-gatti*. It is an implement like a sickle. It is fixed at the heel end of its blade securely into a hole near one end of a plank somewhat in the same way as if it were fixed in a handle. The back of the blade at the bent part rests in order to steady it in a notch in the plank. The blade of the sickle is presented in an upward position opposite to the workman. He sits on the other end of the plank. The plank is about 3 feet long, 1 foot wide, and $1\frac{1}{2}$ inches thick. The husk from each nut is cut out in sections. A nut is grasped in the palm of the hand and pressed against the point and blade. The husk is thus cut through to the nut, then by leverage a section of husk is jerked off. The nut with remnant of husk is turned in the hand so quickly that to an onlooker the action appears involuntary and another section of the husk is removed like the first. With four or five movements of this sort the whole husk is removed. A clever workman can husk 5,000 nuts per day, but three thousand is nearer the average. The contract rate for the work is one anna per 1,000 with two or three meals per day. The husked nuts are scraped free of fibre also by the *matti-gatti*. The process is essentially a scraping process and costs at contract rates $1\frac{1}{2}$ to 2 annas per 1,000.

Contract rates.

Boiling the nuts.

The scraped nuts are next boiled for about two hours in fairly large copper pots. A handful of lime or of the ash of the bark of *matti* (**Terminalia tomentosa**) is added to the water. The presence of lime causes the water to become red or red-brown in colour as the boiling proceeds. The water also becomes thick with a resinous extract from the nuts. The boiling is continued until the eye-bud or germ of growth from each nut comes out or becomes absorbed in the extract. The nuts are removed by a long-handled ladle (*zrâa*). The ladle has perforations in its bowl which allow the extract to drain from the nuts back into the pot. The extract is again and

BETEL-NUT CULTIVATION.

Boiling the nuts.

again used for boiling fresh supplies of nuts, pure water as required being added from time to time to prevent the decoction becoming too thick and concentrated. The extract after being used for boiling repeatedly becomes deep red-brown and thick. It is then emptied into another broad mouthed vessel which is placed under full exposure to the sun. The mass by evaporation thickens and areca catechu or *kossa* is the product. The nuts after boiling are dried in the sun and sorted into three kinds—*chikni*, *betta*, and *gotu*.

Chikni.

Chikni.—These are unripe fruits got mostly from the upper unripe bunches of the tree. They become flat when boiled and when cut are light coloured and agreeably flavoured. They sell by retail at a high price, but by the growers are usually mixed with the other sorts to ensure a satisfactory sale of the whole produce. These nuts after exposure to the sun are again soaked in the red extract, a basketful being immersed at a time. They are again exposed daily to the sun for four or five days, but are gathered up at night, otherwise they get dark coloured. The nuts are exposed to the sun in cane matting spread on a *mandap*. Sometimes bamboos or other means of support are placed over the inner court of the household and the matting spread over this frame-work. The nuts when dry are ready for market and should be shining and bright-red brown in colour.

Betta.

Betta.—These are ripe nuts. They are dried after the first boiling and then hand-rubbed with fairly thick extract to which 3 or 4 per cent. of lime has been added. This tends to deepen the colour. The process may have to be repeated two or three times. The colour becomes fixed by drying in the sun after hand-rubbing. When ready for market they are somewhat lighter coloured than *chikni* and not so glossy or shining. They are rounder and larger.

Gotu.

Gotu.—These are fully ripe or over-ripenuts. They are usually fairly well coloured by the first boiling and after exposure to the sun for several days are ready for market. The colour may be deepened and improved by the same means as described for *betta*.

Prices realised.

The three varieties are usually packed together by the cultivators in sacks. Sirsi and Kumta are the chief markets. Ordinary prices for the three varities are :—

Chikni .	₹6 to 7 per maund of 48 seers of 20 tolas.		
Betta .	„ 3 to 4	ditto.	ditto.
Gotu .	„ 2 to 2½	ditto.	ditto.

in the Bombay Presidency. (*J. W. Mollison.*)

ARECA Catechu.

BETEL-NUT CULTIVATION.

Betel palms are not much affected with disease. A borer does considerable damage. The borers cut a tunnel from the root upwards and in time reach to the growing top. The damage there done is so considerable that the top withers and when wind blows breaks off and falls to the ground.

G. I. C. P. O.—No. 2359 R. & A.—28-5-1900.—000.—E. N. D.

(Vegetable Product Series, No. 54.)
(Gums and Resins.)

THE AGRICULTURAL LEDGER.

1900—No. 5.

MYRISTICA GIBBOSA; ALSO M. KINGII.

(WILD NUTMEG.)

[*Dictionary of Economic Products, Vol. V.*, M. 898a, & 900a.]

ON MYRISTICA KINO OBTAINED FROM WILD NUTMEG TREES OF INDIA.

By MR. D. HOOPER, F.I.C., F.L.S.

MYRISTICA KINO.

ORDINARY KINOS OF INDIA.

The astringent exudations known as kinos obtainable from the barks of Indian trees are of two kinds; Malabar kino, which is far the best, is extracted from **Pterocarpus Marsupium**, while that known as Bengal kino is a product of the *Palas* or *Dhák* tree (**Butea frondsa**). These gums are used largely in medicine as astringents, either alone or combined with other substances, and the first named has been for many years official in the British and United States Pharmacopœias.

Professor Schaer's discovery.

About four years ago, **Dr. Edouard Schaer**, Professor of Pharmacology at the University of Strasburg, wrote a paper,* "On a New Kino in species from Myristica." A specimen of extract or secretion resembling kino had been handed to the author by **Dr. O. Warburg** of Berlin, who had previously received it from the Director of the Royal Gardens and Museums at Kew. The substance was labelled "Kât jadi kai," which was taken to mean "cutch-like product of jadikai" or nutmeg, but the proper rendering of the Tamil expression is more probably, *Kat*=country

* *Pharmaceutical Journal*, Aug. 8, 1896, p. 117.

PROFESSOR SCHAER'S DISCOVERY.

or wild, and *jadikai*—nutmeg, *i.e.*, wild nutmeg, (**Myristic malabarica**), in contrast to the fruit of **Myristica fragrans** whi is imported into India from the Malayan Archipelago. T specimen was like the official kino in appearance, and co sisted of smaller or larger angular transparent pieces, of a de garnet colour when observed in thin fragments.

The most striking reactions of **Myristica** kino were in clo agreement with those revealed by Malabar kino in the following fi particulars :—

Re-actions of Myristica kino.

1. The reddish acid solution, if neutralised with lime water an alkaline acetate, affords a deep violet colour with fe rous sulphate.
2. A violet colouration is observed when the aqueous solution shaken with iron reduced by hydrogen, and then f tered. The violet-coloured solution is decolorised by acid and then assumes a red colour on adding a caustic alkali.
3. Inorganic acids, chromates and salts of lead and copp produce amorphous precipitates in the aqueous solution.
4. The aqueous solution turns distinctly green on addition ferric chloride.
5. The pale brown precipitate of kino-tannic acid, produced acids in the aqueous kino solution, after washing a dissolving again in water, deposits a red sedime (kino-red) on evaporation of the solution at 100°C.

Dr. Schaer also found the sample of **Myristica** kino to yie 1·1 per cent. of ash as the average of several determinations.

The only respects in which it did not agree with **Pterocarpu** kino were that it afforded to ether no trace of catechin or pyr catechin, nor was it possible to obtain any crystals of **Etti's** kino by exhausting with ether the aqueous solution previously heat with hydrochloric acid.

Material for investigation.

Professor Schaer succeeded in obtaining from the Botanic Gardens at Buitenzorg in Java, further specimens of pr ducts of other wild nutmeg trees to test the re-actions their fresh and dried juices; these comprised the juices **Myristica glabra, M. succedanea** and **M. fragran** In each of these exudations **Dr. Schaer** observed a crystalline depo which distinguished them from the kinos from other sourc

THE CRYSTALLINE DEPOSIT.

Dr. van Romburgh of Buitenzorg had noticed this deposit before the juices were sent to Europe, and he attributed the presence of the crystals to the calcium or magnesium salt of an organic acid. Dr. Schaer subsequently determined them as calcium tartrate, a conclusion of some interest in vegetable physiology since the inorganic crystalline bodies peculiar to plants have hitherto been traced to calcium oxalate, sulphate, phosphate and carbonate.

Professor Schaer's Results.

Dr. Schaer summed up the results of his investigation in the following terms :—

"1. The dried juice of the bark of several Asiatic species of **Myristica**, for instance, **M. malabarica**, *Lam.*, and **M. fragrans**, *Houtt.*, as regards their appearance and physical qualities, show but little difference from the official Malabar kino.

"2. This substance which may be termed "Myristica kino" agrees in the chemical re-actions due to their constituents, in all important points, with the kino of **Pterocarpus Marsupium**. It can therefore be stated that drugs of a very similar character, and partly of close resemblance to official kino, are to be found in the families of LEGUMINOSÆ (**Butea**, **Pterocarpus**, **Milletia**), SAXAFRAGACEÆ (**Ceratopetalum**), MYRTACEÆ (**Eucalyptus**, **Angophora**), and MYRISTICEÆ.

"3. **Myristica** kino differs, as far as can be observed, from the **Pterocarpus** kino, and probably also from **Butea** and **Eucalyptus** kino, by containing in the crude state of the inspissated fresh juice, smaller or larger amounts of a distinctly crystalline calcium salt, *viz.*, calcium tartrate, suspended in, and depositing from the liquid juice. By this characteristic admixture it can be easily distinguished from the official kino and probably also from other kinos of commerce."

Occurrence in India.

In a footnote to the above paper reference was made to the "Dictionary of Economic Products," where it is stated on the authority of Kurz that **Myristica longifolia**, *Wall.*, a tree of Sikkim, Assam and Burma, "exudes a red resin."

Kurz, also, in his "Forest Flora of British Burma" remarks that one of the features of this genus is that the bark "abounds in an acrid juice, which is viscid and stains red."

M. 898a & 900a.

MYRISTICA gibbosa. **On Myristica Kino obtained from**

OBSERVED IN TRAVANCORE.

Myristica laurifolia,

The wild nutmeg tree of Travancore is no exception to thi characteristic. Mr. T. F. Bourdillon, Conservator of Forests for thi State, describes **Myristica laurifolia,** *H. f. and T.*, as "a hand some tree with dark green glossy leaves, and straight blackish sten from which a thin red juice exudes." The Tamil name is *Ka Játhikay,* and the Malayalam, *Patthiri.* The wood is said to b almost white, and is often stained with the red juice of the tree, bu it is soft and worthless and decays very rapidly.

Dr. Schaer addressed the Director, Royal Gardens, Kew, with a view to obtaining a specimen of this "red resin" from some of th Indian trees, and the Director forwarded the request to the Reporter on Economic Products to the Government of India for necessary action.

The Conservators of Forests for Assam, Bengal and Burma were communicated with, and officers of that Department were asked to institute a search for the tree **(M. longifolia)**, and to collect samples of juice from the bark. Attempts were made by several officers in Assam and Burma to find this or any particular specimen of wild nutmeg, but although the inquiry lasted during the dry seasons of 1897 and 1898, no results were obtained. Next year, however, their efforts were attended with success, and two species of **Myristica** were found to afford the fluid sought for. The following paragraphs give the details of the history and examination of the products :—

Myristica gibbosa.

1st.—**Myristica gibbosa,** *Hook. f. and T., Fl. Br. Ind. V., 112; Dict. Econ. Prod., Vol. V., M. 898a.*

In May, 1899, Mr. S. E. Rita, Sub-Divisional Officer, Jowai, Assam, sent to the Reporter on Economic Products, a botanical specimen of a tree, and a bottle containing a fluid which the tree yielded when cut or tapped. In the letter forwarding the specimens, Mr. Rita says,

Used as varnish in Assam.

"This fluid seems to be a sort of varnish, and I know that it can be used for this purpose on doors and windows, but as the tree and its properties are not known, I thought it as well to collect this sample of the fluid and send to you. Will you be so good as to examine the specimen and inform me what the name of the tree is, and whether the varnish will prove useful or not."

The material was identified as belonging to **Myristica gibbosa,** *Hook. f. and T.*, and the juice was recorded under Reg. No. 12060.

The contents of the bottle which showed signs of having fermented and were thick and mucilaginous were evaporated to dryness on

M. 898a.

ANALYSIS OF M. GIBBOSA KINO.

water-bath. On reducing the mass to coarse powder, it resembled the peculiar fragments of Malabar kino.

The extract contained an iron-greening tannin, and the amount was estimated; the proportions of insoluble matter, ash and moisture were also determined in the powdered sample with the following results—

Tannin	33·6
Non-tanning sol. matter	25·1
Insoluble matter	26·0
Ash	4·2
Water	11·1

These interesting results confirmed the observations made by **Professor Schaer** with regard to **Myristica** kino and a further effort was accordingly made to obtain more of the "wild varnish" from the Khasi Hills. Early in the present year **Mr. Rita** sent two bottles of the liquid taken from the trunk of **Myristica gibbosa**, a tree which appears to bear in Jowai the vernacular name of *Syndai*. The juice was of a rich claret colour, sour odour and re-action, and astringent taste; a firm gelatinous sediment was discovered in one of the bottles, the other was broken in transit. The clear red juice had a specific gravity of 1·0305 at 24°, and yielded 8·68 per cent. of solid extract when evaporated. The dried kino, prepared by gentle evaporation of the clear juice, was almost indistinguishable in appearance from commercial specimens of Malabar kino. It was quite soluble in hot water with a deep red colour and acid re-action, and the solution gave evidence of a considerable content of kino-tannic acid. It was practically soluble in rectified spirit of wine, but a white crystalline powder was left undissolved, which had the characters of calcium tartrate. The solubility of this salt in the natural juice and in water would indicate the presence of the acid salt or that of the neutral tartrate held in solution by an excess of tartaric or other organic acid. The ash of the inspissated kino amounted to 3·8 per cent., which is much larger than the quantities found in **Pterocarpus** kino. On igniting some of the white crystals obtained by washing 50 c. c. of the clear juice with alcohol, 30·66 per cent. of calcium carbonate was obtained. The formula given for the acid tartrate of calcium is $C^4H^4CaO^6$, $C^4H^6O^6$, which requires 29·58 per cent. of calcium carbonate, while the neutral tartrate, $C^4H^4CaO^6$,

Properties of the juice.

Calcium tartrate present.

MYRISTICA gibbosa. **On Myristica Kino obtained from**

OBSERVED IN TRAVANCORE.

Myristica laurifolia,

The wild nutmeg tree of Travancore is no exception to thi characteristic. Mr. T. F. Bourdillon, Conservator of Forests for thi State, describes **Myristica laurifolia,** *H. f. and T.*, as "a hand some tree with dark green glossy leaves, and straight blackish sten from which a thin red juice exudes." The Tamil name is *Ka Játhikay*, and the Malayalam, *Patthiri*. The wood is said to b almost white, and is often stained with the red juice of the tree, bu it is soft and worthless and decays very rapidly.

Dr. Schaer addressed the Director, Royal Gardens, Kew, with a view to obtaining a specimen of this "red resin" from some of the Indian trees, and the Director forwarded the request to the Reporter on Economic Products to the Government of India for necessary action.

The Conservators of Forests for Assam, Bengal and Burma were communicated with, and officers of that Department were asked to institute a search for the tree **(M. longifolia)**, and to collect samples of juice from the bark. Attempts were made by several officers in Assam and Burma to find this or any particular specimen of wild nutmeg, but although the inquiry lasted during the dry seasons of 1897 and 1898, no results were obtained. Next year, however, their efforts were attended with success, and two species of **Myristica** were found to afford the fluid sought for. The following paragraphs give the details of the history and examination of the products :—

Myristica gibbosa.

1st.—**Myristica gibbosa,** *Hook. f. and T., Fl. Br. Ind. V., 112; Dict. Econ. Prod., Vol. V., M. 898a.*

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The material was identified as belonging to **Myristica gibbosa,** *Hook. f. and T.*, and the juice was recorded under Reg. No. 12060.

The contents of the bottle which showed signs of having fermented and were thick and mucilaginous were evaporated to dryness on

M. 898a.

ANALYSIS OF M. GIBBOSA KINO.

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Properties of the juice.

Calcium tartrate present.

CALCIUM TARTRATE.

requires 53·19 per cent. The acid salt appears to exist in the juice of **Rhus typhina**, *Linn.*, a North American plant (*Dictionary of Chemistry*, Watts, *Vol. V.*, p. 681). The salt is produced (according to Dulk) on adding tartaric acid to lime water till the precipitate redissolves. The crystals are transparent, redden litmus, and are slightly soluble in cold water.

Myristica Kingii.

2nd.—**Myristica Kingii,** *Hook. f., Fl. Br. Ind., V. 100; Dict. Econ. Prod., Vol. V., M. 900 a.*

In July, 1899, Mr. Rogers, Deputy Conservator of Forests, Darjeeling, brought to the Indian Museum a set of botanical specimens of **Myristica Kingii**, *Hook. f.*, called *Ramgowa* or *Ramgua* by the natives, and a bottle of red fluid from the bark. The juice had been collected in response to the request made to the Conservator of Forests, Bengal. The tree had been cut with a knife, and the juice was said to have poured out from the wound. The red fluid showed no disposition to solidify, but a gelatinous precipitate formed in it after some weeks, and mould accumulated on the surface. This juice was evaporated to dryness and reduced to a coarse powder like the previous sample.

Analysis.

Its analysis revealed the following constituents :—

Tannin	30·2
Non-tanning sol. matter	12·5
Insoluble matter	38·1
Ash	6·6
Water	12·6
	100·0

The insolubie portion contained white crystals which were left on the filter paper when the spirit extract was separated. The crystals were insoluble in water, but soluble in acid and reprecipitated in a gelatinous form when the solution was saturated with ammonia. Ignited, the crystals gave off the odour peculiar to burning tartrates, leaving an ash consisting of calcium carbonate.

Conclusions.

If the fresh juice could be collected in any quantity from the wild nutmeg trees of India, and evaporated to dryness without much delay, the residue would be an admirable substitute for commercial kino, if such were needed. But as there is an abundant supply of this article in the forests of the Western Coast, it would be undesirable to place in the market, even if that were possible, any product of a similar nature from another botanical source and a different locality.

M. 900a.

G. I. C. P. O.—No. 2554 R. & A.—28-5-1900.—2,500—J. S. D's.

(Vegetable Product Series, No. 55.)
(Fibres.)

THE AGRICULTURAL LEDGER.

1900—No. 6.

(REPRINT FROM THE BENGAL BULLETIN No. 5.)

AGAVE SISALANA.

[*Dictionary of Economic Products, Vol. I.*, A. 631-35.]

SISAL HEMP.

Experimental Cultivation of the Plant in India. By MAJOR D. PRAIN, M.A., M.B., LL.D., I.M.S., *Superintendent, Royal Botanic Gardens, Sibpur, Calcutta.*

This review of the cultivation of Sisal in India recently appeared as No. 5 of the *Bengal Bulletin*.

Major Prain's account of the experimental cultivation of Sisal Hemp in India is of such value in the present greatly revived interest in that fibre that it deserves to be widely circulated. It has accordingly been thought desirable (with the kind permission of the Director of Land Records and Agriculture, Bengal) to reproduce it in the present issue of *The Agricultural Ledger*. The review is as follows:—

Introductory.

In August 1898 the Honourable C. W. Bolton, C.S.I., Chief Secretary to the Government of Bengal, received from England the subjoined note asking for information regarding the experimental cultivation of the Sisal Hemp plant in India. Mr. Bolton, wishing to answer categorically the questions submitted to him, requested me to help him by supplying what information I could afford. The only question

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INTRODUCTORY.

to which a full reply could be given by me was the first. As, h ever, the remaining questions are exceedingly pertinent and pr tical, I suggested to **Mr. Bolton** the advisability of submitting prin copies of them to the different parties who have received Sisal He plants from the Royal Botanic Gardens or from the Agri-Hortic tural Society of India, requesting the favour of categorical replies each. This suggestion having been approved, the questions w issued to all the gentlemen who have obtained Sisal Hemp pla from this institution; the Secretary to the Agri-Horticultural Soci at the same time very kindly submitted the questions to all who h received plants from his office. The replies received contain mu valuable information, and **Mr. Bolton** has now approved of further suggestion that this information be made available to those w may think of attempting Sisal cultivation in India by issuing it as *Bulletin* of the Agricultural Series.

As the note submitted to **Mr. Bolton** has, in paragraphs B a C, confused the consignment of Sisal regarding which information specially asked with one previously imported, it has seemed bet in answering the first question, to give a complete review of t attempts that have been hitherto made to introduce the plant i India; in order to render the information contained in the replies the other questions more easily appreciated, it has seemed preferab instead of printing separately the answers received from all those w have been so good as to state their experience, to give in every cas *précis* of the information thus supplied.

Note desiring information regarding Sisal Hemp in India.

Note submitted to* the Honourable C. W. Bolton, C.S.I., *regardi Sisal.

A.—**Sir Charles Bernard** wrote me on the 10th March 1898, t on the 16th August 1892, 4,900 plants of the **Agave rigida** *v* **sisalana** (the Sisal Hemp plant of commerce) were sent to In from Kew, which had been recently imported from Florida; and t samples of fibre made from these plants had been forwarded to Imperial Institute in 1896, where the latest information could obtained as to the Sisal Hemp industry in India.

B.—On application at the Imperial Institute and at Kew, no infor ation could be given as to the fate of the plants sent out to India 1892, nothing had been heard about them at Kew, and it was o

AGAVE sisalana.

known, at the Imperial Institute, that some fibre made from them had been received from the Botanical Gardens at Saharanpur.

NOTE DESIRING INFORMATION.

C.—The Curator of the Indian Section of the Imperial Institute kindly forwarded letters that I had addressed to him on the 12th and 19th March 1898, to the Reporter on Economic Products, Calcutta, which resulted in my obtaining 50 Sisal Hemp plants from the Superintendent of the Botanic Gardens, Saharanpur, grown from 50 plants which were received there in 1892, from the Superintendent of the Royal Botanic Gardens, Calcutta, stated to be probably a portion of the consignment sent to India by the Director of the Royal Gardens, Kew.

D.—With the above exception, I have not been able to ascertain anything about the plants, which were sent out from Kew in August 1892, and I am very anxious to get the following particulars about them, with reference to the treatment of 5,000 plants, which I am sending out:—

Particulars wanted.

(1) How were the 4,900 plants distributed that were sent out from Kew on the 16th August 1892, to what persons, in what parts of India?

(2) What soils were they planted in; what distances apart; what growth have they attained; height; width; average number of leaves per plant; length and width of leaves; average weight of leaves?

(3) How long, after being planted out, did they give out suckers; how many suckers does each plant on an average produce every year?

(4) Were they planted out on *raised ground*, banks, etc., or only on high land, but not raised above the surface of the ground?

(5) What soils suit them best? *Will they succeed on lands impregnated with salts*, known in Bihar as "*Oosur*"?

(6) Have any of them died through being planted on damp ground, from cold, or from other causes?

(7) What length of fibre has been obtained from them, and what is its commercial value; what weight or what number of leaves yield a given quantity of *dry* fibre?

(8) How soon after the plants are planted out, can their leaves be cut for extracting fibre, and in how many years after being planted out, do they attain their full growth?

NOTE DESIRING INFORMATION.

(9) How was the fibre prepared that was made from them?

(10) Has any commercial quantity of fibre been made from the *Sisal hemp plant* in *India*, say a bale or two, and with what result, as to yield from the plants, and price obtained for fibre?

(11) Has their cultivation been attempted anywhere in India, on a large scale, for commercial purposes?

REPLIES TO QUESTIONS IN THE FOREGOING NOTE.

Replies. Distribution of the supply sent from Kew in 1892. *Question I.*

QUESTION I.—*How were the 4,900 plants distributed that were sent out from Kew on the 16th August 1892; to what persons; in what parts of India?*

Only 473 plants of this consignment lived to be distributed, 400 of them were made over to the Agricultural Society of India by order of the Government of India, the remaining 73 were sent from the Botanic Garden, Calcutta, to the following persons, *viz.*,—

Mr. A. Peppé, Ranchi, Chota Nagpur . .	20
Superintendent of Jail, Ranchi, Chota Nagpur	12
Deputy Superintendent, Port Blair, Andamans	10
Mr. J. Peter, Mertinga, Manumukh, Assam .	20
Deputy Conservator of Forests, Sonthal Parganas, Bihar	4
Mr. J. Chittayangam, Coimbatore, Madras .	6
Superintendent, Cossipore Institution of Practical Horticulture, Lower Bengal . .	1

How the plant was introduced into India.

As, however, it is impossible to separate the plants of this consignment, distributed by the Agri-Horticultural Society of India, from those of a consignment previously imported by Sir George King, of which the Agri-Horticultural Society also received a considerable share, the present position of the Sisal Hemp industry, which the question is intended to elicit, may be best explained by giving a brief account of the introduction of the plant into India.

When Sir George King, Superintendent of the Royal Botanic Garden, Calcutta, was on leave in 1888, the authorities at Kew kindly undertook to arrange for a consignment of Sisal Hemp plants (**Agave rigida** *var.* **sisalana**) being obtained from America and sent to the Calcutta Garden.

Sisal Hemp in India. (*D. Prain.*) AGAVE sisalana.

INTRODUCTION OF THE PLANT INTO INDIA. First supply sent from Kew in 1890.

This consignment reached Calcutta on 9th July 1890, and it was found on its arrival that every plant was dead and rotten. This first attempt to introduce the plant on an extensive scale (one earlier minor attempt will be alluded to later on) was therefore a failure. Sir George King did not, however, give up his intention of introducing Sisal to India, and at his desire the Director of the Royal Gardens, Kew, kindly purchased for 25 dollars from Messrs. Reasoner Brothers of Florida a lot of 1,000 Sisal Hemp plants. This purchase was made in June 1891. The plants were sent to Kew, where the Director permitted them to remain till they were considered ready to stand the voyage to Calcutta. The consignment reached Calcutta on 29th October 1891, when it was found that 125 plants were quite dead and the rest were in rather a bad state, as many as 232 of the plants dying subsequently to their landing. The second attempt to introduce the plant was thus partially successful, as many as 643 of the consignment of 1,000 plants remaining alive. It was seen, however, that the natural conditions which prevail in the Gangetic delta are unsuitable for this **Agave**, and steps were taken to distribute the plants as soon as possible. The assistance of the Agri-Horticultural Society of India, which is always at the disposal of the Government of Bengal in matters of this kind, was invoked, and 357 plants out of the total of 643 were made over to that body on 29th April 1892 for distribution among its members. Between April 1892 and March 1893 the rest of this consignment was distributed to various parties in India with the exception of four plants put out in the Royal Botanic Garden and seven kept in stock. The distribution is shown fully in the subjoined tabular statement:—

Second supply sent in 1891.

Partly successful.

Distribution of plants sent from Kew in 1891. (Second supply.)

Date of Delivery.	Parties to whom made over.	Number of plants issued.
1	2	3
29th April 1892 . . .	Agri-Horticultural Society of India.	357
15th July „ . . .	Government Botanic Garden, Saharanpur.	50
15th „ „ . . .	Government Horticultural Garden, Lucknow.	50

AGAVE sisalana.

Experimental Cultivation of

DISTRIBUTION OF PLANTS SENT FROM KEW IN 1891.

(Second supply.)

Date of Delivery.	Parties to whom made over.	Number of plants issued
1	2	3
15th July 1892	State Gardens, Gwalior	5[illegible]
25th „ „	Agri-Horticultural Gardens, Lahore.	5[illegible]
30th „ „	Lecturer on Botany and Agriculture, Poona.	1[illegible]
8th September „	Deputy Superintendent, Port Blair.	2[illegible]
4th October „	Mr. J. W. Burnett, Tellicherry	1[illegible]
23rd February 1893	Deputy Superintendent, Port Blair (second issue).	1[illegible]
11th March „	Manager, Mahamera Tea Estate, Desangmukh, Assam.	12
27th „ „	Honourable J. W. Buckingham, C.I.E., Amguri, Assam	3
	Total distributed	632
	Planted in Royal Botanic Garden, Calcutta . 4	
	Still in stock in nursery on 27th March 1893 . . . 7	11
	Total of living plants in consignment	643
	Received dead . . 125	
	Sickly on arrival and afterwards died . . . 232	
	Total of dead plants	357
	Total purchased	1,000

Sisal Hemp in India. (*D. Prain.*)

AGAVE sisalana.

DISTRIBUTION OF PLANTS SENT FROM KEW IN 1892.

(Third supply.)

The authorities at the India Office appear to have become aware of the efforts of the Government of Bengal to introduce Sisal to India and to have generously decided to relieve it of the expense it was thus incurring, for on 16th August 1892 a third consignment of 4,900 plants was sent out from Kew to India and a demi-official letter of advice from the India Office was addressed to **Sir George King** announcing the fact. This consignment was not, however, intended for the Royal Botanic Garden, Calcutta, but for the Government of India in the Department of Revenue and Agriculture, and by a telegram, dated 7th September 1892, **Sir George** was instructed to make over 2,000 plants to the Secretary to the Agri-Horticultural Society and 500 to **Mr. G. Dickinson,** Kumergode Estate, Mysore, and to dispose of the balance as was thought best. The consignment did not reach the Botanic Garden till October 14th, 1892, and it was found that only 2,984 plants remained alive of the total consignment of 4,900 and that all of these were in a very sickly condition. The Government of India was, therefore, asked to sanction the retention of the consignment till some of the survivors had recovered sufficiently to admit of their being distributed. It was evident that very many of the sickly plants must ultimately die, and that there would not be left enough to provide 2,000 for the Agri-Horticultural Society and 500 for **Mr. Dickinson.** It was, therefore, suggested that the survivors be distributed in the proportion of one to **Mr. Dickinson** for each four to the Agri-Horticultural Society. The Government of India approved of this suggestion on 2nd November 1892. Of the 2,984 still alive but sickly on their arrival, as many as 2,511 died before June 1893, and by an arrangement effected, I believe, in conversation between **Sir Edward Buck,** then Secretary to the Government of India in the Department of Revenue and Agriculture, and **Sir George King,** it was decided that it was not worth while sending a consignment to Mysore, as the chances were altogether against the plants standing the journey. It ought to be added that **Mr. Blechynden,** then Secretary to the Agri-Horticultural Society, visited the Botanic Garden on more than one occasion to see the plants, and it was not until he felt satisfied that those intended for the Society were fit to be moved that any of the surviving plants were sent out. The actual distribution of this consignment, the one now under reference from the India Office, has been as follows (as the consignment was not intended for

AGAVE sisalana.

Experimental Cultivation of

DISTRIBUTION OF PLANTS SENT FROM KEW IN 1892.

(Third supply.)

the Government of Bengal, none of the plants belonging to it ha been kept at Calcutta) :—

Date of Delivery.	Parties to whom made over.	Number plants issued.
1	2	3
5th June 1893 . .	Agri-Horticultural Society of India (second issue).	400
19th July „ . .	Mr. A. Peppé, Ratnaghar, Ranchi	20
10th August „ . .	Deputy Superintendent, Port Blair (third issue).	10
11th „ „ . .	Mr. J. Peter, Mertinga Tea Estate, Manumukh.	20
20th September 1894 .	Superintendent, Cossipore Institute of Practical Horticulture.	1
18th June 1896 . .	Mr. J. Chittayangam, Coimbatore .	6
5th August „ . .	Deputy Conservator of Forests, Sonthal Parganas.	4
2nd February 1897 .	Superintendent of Jail, Ranchi .	12
	Total distributed .	473

Stock exhausted.

Total of living plants		473
Received dead	1,916	
Sickly on arrival and dying subsequently	2,511	
Total of dead plants		4,427
Total despatched from Kew, 16th August 1892		4,900

Agri-Horticultural Society of India.

The subsequent history of the plants of these consignment that were made over to the Agri-Horticultural Society of India ha been that practically all were distributed to members of the Societ

AGAVE sisalana.

likely to be interested in Sisal cultivation. The Secretary found his experience as to the unsuitability of the plant for cultivation in the neighbourhood of Calcutta to be the same as our own and in the Society's gardens only a few plants are now left. The subjoined list of parties who took Sisal plants in quantity from the Agri-Horticultural Society of India has been kindly supplied by the present Secretary to the Society, Mr. Lancaster. The dates of issue are not shown, and I am unable to say how far the various lots distributed belong to the consignment imported by Sir George King for the Government of Bengal in 1891 and how far they belong to the consignment sent by the India Office for the Government of India in 1892:—

BENGAL. Distribution of Sisal plants by Agri-Horticultural Society.

Parties to whom made over.	Number of plants issued.
Mr. J. D. Macgregor, Tirhoot	50
Mr. J. Lawrie, Dauracherra, Cachar	50
Mrs. H. Herbert & F. F. Mackenzie } address not known to Mr. Lancaster	50
Messrs. H. E. Abbot & Co., Calcutta	100
Kangekoah Tea Estate, Assam	50
Chota Nagpur Tea Estate, Ranchi	50
Mr. A. Cook, Ranchi	50
Mr. E. M. Thomson } addresses not known to	50
Mr. E. Bryning } Mr. Lancaster	100
Messrs. Grindlay & Co., Calcutta, on different occasions	150
Others in small batches ranging from 2 to a dozen	343
TOTAL	1,043

As this number is in excess of the number of plants originally made over to the Society, it indicates that multiplication by offsets has been taking place to some extent.

The subsequent history of the plants made over to different parties has varied a good deal.

Saharanpur.

(1) Of the 50 plants of the 1891 consignment sent to Saharanpur, Mr. Gollan, Superintendent, reports that he still has 49. Suckers sent up by them have been sent to all parts of the world, but he has no exact record of their distribution; his office is so small that it is

SAHARUNPUR.

impossible to keep an account of everything sent out. Befo Mr. Gollan received these, he had, however, a single specimen of t Sisal Hemp plant yielding suckers. This plant was the sole surviv of several small suckers received by post in 1885 or 1886 fro Messrs. Reasoner Brothers, Florida.

Lucknow.

(2) Of the 50 plants of the 1891 consignment sent to Lucknow 40 were planted out in the Date Plantation, this being the only avai able spot. Several had died while they were kept in the pots. Th Sisal plant, Mr. Ridley, Superintendent, reports, has not done well Lucknow, owing to its being planted in poor soil.

Gwalior.

(3) From the 50 plants of the 1891 consignment sent to Gwalio Mr. Maries, Superintendent, reports that he has already manage (1898) to rear 55 more; he has now 105 large plants that yiel suckers freely, and hopes to put out several thousands this season.

Lahore.

(4) Regarding the 50 plants of the 1891 consignment sent t Lahore, no report has been received.

Bombay, Mr. Woodrow's report

(5) Of the 15 plants sent to Poona, Mr. Woodrow, Lecturer o Botany and Agriculture there, reports as follows:—I have the honou to precede my replies to the queries submitted to me by a statemen of the plants received and on hand at this date—

Received in 1892 from the Calcutta Botanical Garden				.	15
Ditto	ditto	Saharanpur	ditto	.	2
Ditto	dttto	Kew	ditto	.	12
					29
On hand in September 1898 at Poona				.	400
Ditto	ditto	Nandgaon		.	400
Distributed				.	60
			TOTAL	.	860

Summary of particulars regarding plants sent to Poona,

It may, therefore, be assumed that the 15 plants sent to Poona from Calcutta of the consignment of 1891 have, by propagation, increased to 400 full-grown plants. It will be noticed that 12 plants were sent direct to Poona from Kew in 1892, perhaps about the time that the consignment of 4,900 under reference was sent to the Government of India. But these 12 plants did not form part of that consignment. It will also be observed that 2 plants were sent in 1892 to Poona from Saharanpur. As these could not both have been part of the

POONA.

Government of Bengal consignment of 1891, since Mr. Gollan still has 49 of the original 50 plants given to him of that consignment, I have written to Mr. Gollan regarding them. Mr. Gollan informs me that neither of the two belonged to the consignment sent to him by Sir George King in 1892, but that both were suckers obtained from the solitary survivor of the small consignment sent by post direct from Florida to Saharanpur in 1885 or 1886. In the revised prospectus of a proposed "Bombay Sisal Company" Mr. Woodrow's original 29 plants are said to have increased to 10,000. This must include not only all suckers, but also all the small bulbils from the original plants, which have now begun to pole.

Andamans.

(6) Of the plants sent to the Andamans on three separate occasions, 35 belonged to the Bengal consignment of 1891 and 10 to the India Office consignment of 1892. Mr. E. H. Man, C.I.E., reports that there appear to be two varieties of the plant, one having small almost minute thorns along the edges of the leaf, the other having much longer thorns. As Mr. Man happens to be the only officer supplied from the Calcutta Garden with plants from both the consignments, it is interesting to find this remark in his report; as none of the other parties who reply to the questions put by the India Office mention this fact, it leads one to suspect that the plants of the two consignments may have differed somewhat. Unfortunately all the plants of the India Office consignment, which was not intended for the Royal Botanic Garden, were distributed. During the time, however, that there were plants of both consignments in the Calcutta nurseries the two did not appear to differ materially. Of the whole 45 plants sent to Port Blair, 38 did well and are still alive. Twenty-four of them are throwing out suckers now at the rate of 6 per plant annually, and 240 new plants have thus been already obtained.

Madras. Tellicherry.

(7) Of the 10 plants of the 1891 consignment sent to Telicherry, Mr. Burnett still has 8. They throw out suckers freely, and never having been moved, now form a matted mass of suckers, leaves, etc., and look very healthy.

Assam. Desangmukh.

(8) Of the 12 plants of the 1891 consignment sent to Desangmukh, 11 are still alive.

(9) Of the 3 plants of the 1891 consignment sent to Honourable J. Buckingham, C.I.E., only 1 is now alive, but from suckers yielded by it Mr. Buckingham has obtained 4 young plants.

AGAVE sisalana.

Experimental Cultivation of

RESULT OF ENQUIRIES MADE re plants sent from Kew in 1892. (Third supply.)

For the India Office consignment of 1892 as apart from th Bengal consignment of 1891, no definite information can be given as already explained, as regards the plants made over to the Agr Horticultural Society of India, or as regards those sent to the Anda mans. As regards the others:—

(1) **Mr. Peppé** of Ranchi, who received 20 plants, has not replie to my request for information.

(2) **Mr. Peter** of Mertinga Tea Estate, Manumukh, who receive 20 plants, does not say how many new plants he has been able t propagate, but the number is probably considerable since he report having put down 20 to 30 acres.

(3) The Superintendent of the Cossipore Institution of Practica Horticulture, who obtained a plant, has not answered my enquiries.

(4) **Mr. Chittayangam**, Coimbatore, who received 6, has no replied to my letter of enquiry.

(5) The Deputy Conservator of Forests, Sonthal Parganas, who obtained 4 plants for the Kalikhand Nursery, still has all 4 and has 16 young plants raised from suckers.

(6) The Superintendent of the Ranchi Jail has not answered my letter of enquiry; he obtained 12, but has only had them for two years.

In order that as full information as possible might be obtained regarding the various points to which the India Office directs attention, printed copies of the questions were sent to every correspondent of the garden who has received plants of Sisal, and replies, more or less complete, have been received from the following:—

Superintendent, Botanic Garden, Saharanpur.
Ditto, Government Garden, Lucknow.
Ditto, State Garden, Gwalior.
Lecturer on Botany and Agriculture, Poona.
Deputy Superintendent, Port Blair.
J. W. Burnett, Esq., Tellicherry.
Manager, Mahamara Tea Estate, Desangmukh.
Honourable J. Buckingham, C.I.E.
J. Peter, Esq., Mertinga Tea Estate, Manumukh.
Deputy Conservator of Forests, Sonthal Parganas.

Sisal Hemp in India. (*D. Prain.*) AGAVE sisalana.

RESULT OF ENQUIRIES *re* plants sent to India in 1892.

Mr. Lancaster, Secretary to the Agri-Horticultural Society of India, was so good as to send copies of the questions to all the parties, whose addresses could be ascertained, that had received plants from the Society and has transmitted to me copies of the replies received from the following gentlemen :—

J. D. Macgregor, Esq., Arrowah Concern, Saran.
J. Lawrie, Esq., Lungai, Munshi Bazar, Sylhet.
Messrs. Thomson & Mylne, Jagdispur, Behea.
Manager, Lunglah (Sylhet) Tea Company, Limited.
A. Cooke, Esq., Ranchi.
Manager, Pathecherra Tea Estate, Cachar.

Abstract of information received.

A *précis* of the information contained in these replies is given under each of the remaining questions.

Question II.

QUESTION II.—*What soil were they planted in; what distances apart; what growth have they attained; height; width; average number of leaves per plant; length and width of leaves; average weight of leaves?*

Soil in which planted and distance apart.

At Saharanpur, the plants were put out in heavy loam 3 feet by 3 feet apart; at Lucknow, in poor sandy loam 6 feet by 6 feet apart; at Gwalior, they were placed in red soil without manure or irrigation; at Poona, in strong loam not manured, slighty irrigated the first year, 6 feet by 6 feet apart (it has since been found at Poona that 5 feet by 5 feet apart is sufficient); at Port Blair they were planted in strong clay along roadsides 7-11 feet apart; at Tellicherry, they were placed in a vegetable garden, in ordinary Malabar laterite, 3 feet by 3 feet apart; at Mertinga, Assam, in stony laterite soil 5 feet by 5 feet apart; at Katikund, Sonthal Parganas, in hard reddish poor soil with gravel a foot and a half below, 3 feet by 3 feet apart; at Arrowah, Saran, in sandy loam, 20 feet by 20 feet apart; at Lungai, Assam, in light sandy soil; at Ranchi, among tea; at Pathecherra, Cachar, in good loamy soil, 5 feet by 5 feet apart.

Abstract of replies received.

There are thus three instances of the selection of 3 feet by 3 feet as the distance apart against two of 5 feet by 5 feet and two of 6 feet by 6 feet. There is no doubt that 3 feet by 3 feet is too close, while 20 feet by 20 feet, the distance in one case, is too remote. Perhaps 5 feet by 5 feet is the best distance.

Height and width.

The height and width of the plant varies a good deal, 2 feet 9 inches

ABSTRACT OF REPLIES RECEIVED.

Question II.

Height and width.

by 3 feet 6 inches being the smallest (Sonthal Parganas), but in th case the soil was very poor and the plants had been received on two years before. Almost as small, however, are the plants Lucknow, 3 feet by 4 feet; these are planted in poor sandy loar The height is given at 5 feet at Gwalior; at 5 feet with a width of feet at Saharanpur (heavy loam); at 5 feet 3 inches, width 6 feet, Mertinga, Assam; at 6 feet, width 6 feet, at Desangmukh, Assam at 6 feet, width 8-9 feet, at Port Blair (plants 7-11 feet apart); at feet 6 inches at Pathecherra, Cachar; at 7 feet (in light sandy soi at Dauracherra, Sylhet; at 7 feet, width 7 feet, at Poona; and at feet, width 8 feet, at Arrowah, Saran (plants 20 feet apart).

Number of leaves.

The number of leaves per plant also varies a good deal; fro 25-30 at Lucknow (poor soil); 35 in Sonthal Parganas (plants on two years put out); 50, Saharanpur, Cachar, Tirhut; 60-70, Po Blair; 72, Mertinga, Assam; to 80, Poona. The length and widt of leaves also varies as does the weight; from 2 feet by 3 inche weight about 5 ounces (Sonthal Parganas) and 2 feet 6 inches by 3 inches, weight 8 ounces upwards. The largest leaves reported a those from Tellicherry, 6 feet 3 inches to 6 feet 6 inches long by 4 to 5 inches wide weighing $2\frac{3}{4}$ lbs., and Lungai, Sylhet, 5 feet 6 inche long by 6 inches wide weighing $3\frac{1}{2}$ lbs. More usual sizes and weight are 4 feet 6 inches by 5 inches (Poona), 4 feet 6 inches to 5 feet by inches (Port Blair); 5 feet by 5 inches (Arrowah, Saran) all weighin 2 lbs. The length, width and weight recorded from Saharanpur ar 4 feet 6 inches by $3\frac{1}{2}$ inches weighing $1\frac{1}{2}$ lbs. and from Desangmuk 4 feet 4 inches by $4\frac{3}{4}$ inches weighing $1\frac{1}{4}$ lbs.

Question III.

Question III.—*How long after being planted out did they giv out suckers; how many suckers does each plant on an average produ each year?*

When the plant produced suckers.

At Saharanpur and in the Sonthal Parganas the plants began t send up suckers in the second year, though at Saharanpur only th stronger plants did so; while at Lungai, Sylhet, they began to do s in the first year, and at Pathecherra, Cachar, they are stated to hav begun to appear in the first or second year. At Port Blair the began to appear in the second or third year, but only partially a Arrowah, Saran, after $2\frac{1}{2}$ years. At Lucknow and at Poona, sucker began to appear only in the third year, while it is reported that a Mertinga, Assam, no suckers appeared till the fifth year, and the

Abstract of replies received. *Question III.*

ABSTRACT OF REPLIES RECEIVED.

only partially, and at Ranchi it is said no suckers have yet appeared at all.

Number of suckers per plant.

The average number of suckers per plant per annum is given as 4 in the Sonthal Parganas, 5 at Poona, and 6 at Port Blair, at Saharanpur and in Tirhut the number is given at 9-12 and 10-12, respectively.

Question IV.

QUESTION IV.—*Were they planted on raised banks, etc., or only on high land, but not raised above the surface of the ground?*

Whether planted on raised or level ground.

At Saharanpur the plants were planted on raised banks. At all the other places from which reports were received they were put out on level ground or on ground above flood level, but not raised, except at Poona where the plants were put out partly on raised banks, partly on high land not raised. It was found at Poona that there was no perceptible difference in the plants from the two situations.

Question V.

QUESTION V.—*What soil suits them best? Will they succeed on lands impregnated with salts, known in Bihar as "Oosur"?*

Soil best adapted.

Here a decided difference of opinion exists. The Manager, Pathecherra Tea Estate, Cachar, says the richer the soil the better the plant, and Mr. Cooke of Ranchi is of much the same opinion, while the Manager of Dauracherra, Cachar, says light sandy soil is best, but ordinary soil does very well, and remarks that if the soil be too rich there is rapid growth, but the fibre is then not so good. Mr. Gollan, Saharanpur, finds heavy loam raised in the form of an embankment to suit them well, and Mr. Macgregor, Arrowah, Tirhut, advocates good sandy loam. Mr. Maries, Gwalior, finds ordinary red soil very good; Mr. Man, Port Blair, finds the plants do best in poor, well-drained stony soil, and Mr. Woodrow, Poona, states that rough, stony soil with 5 per cent. lime suits them well.

"Oosur."

As regards "Oosur," only two correspondents venture to express an opinion. Mr. Maries, Gwalior, says the plants do well in "Oosur" if grown on raised mounds, while Mr. Macgregor, Tirhut, says they will not grow on "Oosur."

Question VI.

QUESTION VI.—*Have any of them died through being planted in damp ground, from cold or from other causes?*

On casualties.

The majority of the correspondents say that none of their plants have died. Mr. Gollan, Saharanpur, says none were planted in damp ground, but plants under pot culture have died, probably from over-watering. Mr. Ridley, Lucknow, has had the same experience; Mr. Buckingham, Assam, lost most of his plants from their having been

ABSTRACT OF REPLIES RECEIVED.

planted in too shady a spot; **Mr. Man**, Port Blair, lost four that were planted in a damp spot. **Mr. Macgregor**, Arrowah, Tirhut, reports that 50 per cent. of his plants died within a month of being put down *in pots*; the rest are thriving luxuriantly. The Manager of Lungla Tea Estate, Sylhet, states that all the plants received in 1893 died through neglect during his absence in England in 1894. **Mr. Cooke** of Ranchi says that several, planted in poor soil, died.

Question VI.

Question VII.

QUESTION VII.—*What length of fibre has been obtained from them, and what its commercial value; what weight or what number of leaves yield a given quantity of dry fibre?*

Length of fibre.

The Manager, Pathecherra Estate, Cachar, finds the average length of fibre to be 36 inches, but says nothing about the proportion of fibre obtained to leaf employed. **Mr. Peter**, Mertinga, Assam, finds that 184lbs. of leaf yield 6lbs. of dry fibre, but does not state the average length of fibre obtained. **Mr. Woodrow**, Poona, also finds the fibre to average 36 inches in length; and finds the proportion of fibre to leaf to be about 3 per cent. **Mr. Burnett**, Tellicherry, obtained from a single leaf, 78½ inches long, fibre 78 inches long, and from another leaf 75 inches long, fibre 74 inches long. The weight of the first leaf was 44 oz., the quantity of fibre obtained weighed 2½ oz.; the weight of the second leaf was 42 oz., the fibre obtained weighed 2 oz. **Mr. Burnett's** ratio is thus from 4¾ to 5½ per cent., and is considerably higher than that of **Mr. Woodrow** and **Mr. Peter**. His samples seem to have been prepared with special care.

Commercial value.

Having seen it stated that the **Right Honourable Mr. Chamberlain** was making a profit from Sisal in the Bahamas, **Mr. Burnett** was led to submit a sample of his fibre to a firm of produce brokers in Mincing Lane; the name of the firm is not mentioned. The firm praised the quality of the sample, but did not give quotations, and expressed a doubt as to whether any profit was being made in the Bahama Sisal Plantations. The matter, therefore, ended there.

Reports of experts.

Mr. Woodrow, Poona, sends a reprint of a note on Sisal Hemp from the Indian Textile Journal in which the reports of three London firms on samples of Sisal fibre from Poona are quoted in full. **Messrs. King, King & Co.'s** broker reports that in length and brightness the sample is considered far above the average, partaking of the character of Bahama Sisal rather than Mexican, and at the present moment is worth £30 a ton. If Sisal were offered more freely, there would be

ABSTRACT OF REPLIES RECEIVED. *Question VII.*

a drop of £4 per ton, but at £26 per ton it is thought a regular trade could be done in the quality of the sample packed in bales of 2 cwt.

Messrs. Thirkell & Co., produce brokers, report the sample as of superior quality, similar to the better class of Bahama Sisal, and likely to sell freely in London at market prices. The value during the past 12 months has at times exceeded £30 per ton; in a weak market the value is about £22 to £23 per ton landed in London, but an average value of about £18 per ton would be nearer the mark. Messrs. Ide & Christie's broker reports that the Poona sample of Sisal is good, bright and well cleaned, its value being £28 per ton. At the time of report, however, rates were nominal, and the broker considered that to get into large use £8 to £10 per ton less money was wanted.

Samples from Gwalior and Poona compared.

Samples have been sent to me from Mertinga, Assam; from Tellicherry; from Saharanpur; and from Gwalior, as well as from Poona. Of these the Gwalior sample is quite and the others nearly, if not quite, up to the Poona sample as regards brightness. Mr. Gollan, Saharanpur, informs me that the Imperial Institute was furnished with fibre from Saharanpur through Dr. Watt in January 1896 and again in October 1896. The fibre was produced by the plants sent to Saharanpur by Sir George King in 1892. The first lot of fibre was sent spontaneously to Dr. Watt by Mr. Gollan, as Mr. Gollan wished to have Dr. Watt's opinion on its quality; Dr. Watt forwarded that fibre to the Imperial Institute. The second lot was sent at Dr. Watt's request.* Mr. Gollan is under the impression that he told Dr. Watt at the time that the fibre was the produce of plants sent to Saharanpur by Sir George King in 1892. It is probable that this statement has led the authorities at the India Office to suppose that the Saharanpur fibre was the produce of the 1892 consignment sent by the India Office. As I have already indicated, however, Mr. Gollan received no plants of that consignment, and was in all probability unaware of its ever having been sent. The mistake, however, is not of material consequence.

Conf. Agricultura Ledger, 1894, No. 34.

Question VIII.

Question VIII.—*How soon after the plants are planted out can their leaves be cut for extracting fibre, and in how many years after being planted out do they attain their full growth?*

When fit for extracting fibre.

The Manager, Pathecherra, Cachar, says the leaves may be cut after two years, but the plants do not reach their full growth for four

* I do not find from the correspondence in my office that he did so.—ED.

ABSTRACT OF REPLIES RECEIVED

Question VIII.

Age at which the plants attain maturity.

years. Mr. Macgregor, Arrowah, Tirhut, says they may be cut after three or four years. Mr. Woodrow, Poona, believes three years is about the time required to produce leaves fit to cut; plants received in 1892 are now (1898) beginning to send up flower stems indicating the attainment of full growth. Some are, however, at least a year later. Mr. Gollan, Saharanpur, says leaves may be cut for experimental purposes within two years; for commercial extraction of fibre not till the fourth year. The Manager, Dauracherra, Cachar, also says that the leaves are ready to cut in the fourth year after planting, but adds that the fibre obtained will be short and not of such good quality as that of after years Mr. Peter, Mertinga, Assam, thinks probably five years after planting out is the most suitable time to begin cutting. Mr. Burnett, Tellicherry, is not prepared to say that there is any definite time.

Question IX.

QUESTION IX.—*How was the fibre prepared that was made from them?*

Fibre from the plants how prepared

At Poona the fibre was prepared tentatively by two methods: (1) hand-scraping with the edge of a piece of hoop-iron on a board: (2) leaves were torn into shreds, dried in the sun, soaked in water for about 10 days, beaten and washed. At Saharanpur the fibre was extracted by hand. At Tellicherry it was obtained by scraping. Mr. Burnett has also soaked some of his leaves, but does not find much difference in quantity or quality of fibre. At Pathecherra, Cachar, the leaf is first beaten with a wooden mallet, then scraped with a sharp-edged piece of iron, washed and put in the sun.

Question X.

QUESTION X.—*Has any commercial quantity of fibre been made from the Sisal Hemp plant in India, say, a bale or two, and with what result as to yield from plants, and price obtained for fibre?*

Commercial quantity.

Not as yet apparently.

Question XI.

QUESTION XI.—*Has their cultivation been attempted anywhere in India on a large scale for commercial purposes?*

Cultivation of the plant on a commercial scale.

Madras.— Mr. Burnett, of Tellicherry, thinks that no attempt has been made in the Madras Presidency. On himself making enquiry about land in which to grow the plant on a large scale, Mr. Burnett found that no large area of suitable quality was procurable, and the natives of his district are so anxious to invest in land that prices rule very high.

AGAVE sisalana.

ABSTRACT OF REPLIES RECEIVED.

Question XI.

Bombay.—Mr. Woodrow reports that the Government Plantation at Nandgaon, Western Ghauts, is worked on commercial lines. Mr. Woodrow obtained permission from the Government of Bombay to experiment with Sisal on forest land, and selected a piece of very poor forest at Nandgaon village, 9 miles south of Lanauli on the road from Lanauli to the village Ambowné. There are now 400 plants at that place. The labour employed has been sufficient only to plant and make fire-traces for protection against forest fires. Trees are left standing. As the plants at Poona have begun to pole, a rapid increase in the area planted at Nandgaon may be expected.

In December 1898 a scheme for the cultivation of Sisal on an extensive scale was projected, and the preliminary prospectus of a Company, to be called the Bombay Sisal Hemp Company, was issued. The capital required is estimated at ₹1,00,000, and ₹10,000 has been subscribed. Whether the Company has been successfuly floated is not yet known. It was proposed to ask the Government of Bombay for a lease of 10,000 acres of forest land, but it has not transpired whether the Bombay Government has granted this request, or indeed whether it has been formally made.

Central India.—Mr. Maries, of Gwalior, is planting extensively; he knows of no other attempt.

Cultivation of the plant on a commercial scale.

Central Provinces.—No information.

Panjab.—No information.

North-West Provinces.—Both Mr. Gollan, of Saharanpur, and Mr. Ridley, of Lucknow, are unaware of any attempt on a large scale in the North-West Provinces. Mr. Gollan thinks no such attempt has been made. Mr. Ridley says there has been no demand for the plant from the Lucknow garden.

Tirhut.—Mr. Macgregor, of Arrowah, Saran, knows of no attempt. Mr. Gollan, of Saharanpur, suggested a reference of this question to Mr. J. V. Webb, of Chitwarrah, but Mr. Webb has not replied to my reference. Messrs. Thomson & Mylne of Behea state that they were interested in the endeavour of Government to further the cultivation of Rhea and Sisal, and it occurred to them that the preparation of the fibres might be made a domestic occupation for the women and children of Brahmin and Rajput families on the Jagdispur Estate. The plants being perennial could be cultivated on the borders of

AGAVE sisalana

ABSTRACT OF REPLIES RECEIVED.

Question XI.

Experimental Cultivation of

their fields, and with this idea the firm planted and cultivated patches of both plants to show the facility with which they could be grown and propagated by the men of the family. This was freely admitted by the men, but, as no result followed, the plants were reluctantly cleared from the ground.

Chota Nagpur.—Mr. Cooke, of Ranchi, thinks no commercial attempt to grow Sisal has been made, and, moreover, expresses his belief that it would not pay as an industry.

Chittagong.—A recent letter in the Calcutta *Englishman* advocates the establishment of the industry in Chittagong, from which I infer that so far it has not been attempted there on a large scale.

Assam.—The Manager, Pathecherra Estate, Cachar, thinks it is being tried on a large scale at Manumukh by Mr. Hunter. Mr. Peter, of Mertinga, Manumukh, says that 20 or 30 acres have been put down, but that no fibre has yet been extracted. Mr. J. Lawrie, of Lungai, Munshi Bazar, says that the largest plantation known to him is that at Dauracherra, the plants for which were imported from Florida. He believes this plantation is meant for the production of bulbils, and as the plants have not been cut they are expected to pole soon. It will be seen from the list supplied by Mr. Lancaster, Secretary to the Agri-Horticultural Society, that Mr. Lawrie himself is mentioned as having received from the Society 50 plants on behalf of the Dauracherra Estate. These plants were amongst those first distributed by Mr. Blechynden, Mr. Lancaster's predecessor, and were, therefore, almost certainly part of the Bengal consignment of 1891 which Sir George King imported from Florida. Mr. Lawrie's remark may, therefore, only have reference to these plants, though, as it stands, it may also mean that the Dauracherra Estate has itself made a direct importation of young plants from Florida.

[Since the foregoing pages were set up in type, The Editor has been favoured by Major Prain with copies of the appended correspondence which explains itself.]

From—Dr. A. G. Bourne, F.R.S., *Honorary Secretary, Agri-Horticultural Society, Madras,*

To—Major D. Prain, I.M.S., *Superintendent, Royal Botanic Gardens, Sibpur, Calcutta, No. 208, dated Madras, the 2nd February 1900.*

In perusing your Bulletin No. 5 (Agricultural Series No. 4) of 1899 about Agave rigida *var.* sisalana, I find no mention is made

MADRAS. Agri.-Horticultural Society.

regarding our experiments and distribution of the plant. Mr. Burnett, of Tellicherry, is not quite correct in saying that there was no attempt made in Madras as you will find in reference to the Society's Proceedings, pages 16, 17, 104, 132 and 150 of Volume VIII, pages 93 and 214 of 1897, and 17 of 1898, that 24 plants were received from the Royal Gardens, Kew, in 1890, and the same was propagated by suckers and bulblets and that a large number about 3,000 were distributed to the following places :—

(*Correspondents and Members.*)

2 plants to Tallapodi in June 1891.
2 ,, Mysore Government Garden in May 1891.
27 ,, Calicut in February 1896.
(Through the Government of Madras in 1898.)
3,000 ,, Cuddapah, Bellary, Anantapur, North Arcot and Madura.

We may mention that we have now a large stock to be disposed of through Government for planters and ryots who may wish to establish estates. It flowers with us very well and produces thousands of bulblets in each flower spike.

From—Major D. Prain, I.M.S., *Superintendent, Royal Botanic Gardens, Sibpur, Calcutta,*

To—Dr. A. G. Bourne, F.R.S., *Honorary Secretary, Agri-Horticultural Society, Madras.*

I am greatly obliged to you for your letter No. 208, dated 2nd February 1900, regarding the distribution of Sisal by the Agri-Horticultural Society of Madras.

I think I made it clear that, with a view to answering the questions put to me by the Government of Bengal, I issued these questions to all the parties who had, to my knowledge, directly or indirectly received plants of **Agave sisalana** from the Royal Botanic Garden. Two of these parties, the Superintendents of the Government Gardens at Poona and at Saharanpur, had, like your Society, been themselves engaged in independent attempts to introduce the plant into India, and owing to the fact that they had likewise received plants from this institution, I was made aware of their own independent attempts. No plants having been sent from these gardens to your gardens it did not fall within the scope of my note to treat of what had been done by you, though I would certainly have gladly added to it a

AGAVE sisalana.

Experimental Cultivation of Sisal Hemp in India.

MADRAS. Agri.-Horticultural Society.

reference to your work had anything occurred in the course of my correspondence with recipients of the plant to direct my attention to the references which you kindly quote.

Although the note on Sisal has appeared as a *Provincial Bulletin*, it has not, so far as I am aware, yet been issued as an *Agricultural Ledger*, and in the hope that it has not yet been issued in that form I am sending a copy of your letter, and of my reply to it, to the Reporter on Economic Products to enable him to incorporate the interesting information you now give.

I may add, for your information, that since preparing my note I have learned that two private importations from Florida of Sisal Hemp plants, one in the Tirhut (Indigo) area and one in the Assam (Tea) area, have taken place, the parties concerned have said nothing about these importations, and all that I am able to say regarding them is that the efforts of the various Indian Governments detailed in my note on Sisal *plus* those of your Society and of the Government of Madras are, when put together, insignificant as compared with either of these private ventures.

A. 631-35.

(46)

G. I. C. P. O.—No 2073 R. & A. D.—6-5-1900—2,300.—R. N. D.

(Vegetable Product Series, No. 56.)
(Gums and Resins.)

THE AGRICULTURAL LEDGER.

1900—No. 7.

MACARANGA ROXBURGHII.

(GUM.)

[*Dictionary of Economic Products, Vol. V,* M. 15-20.]

A NEW KINO FROM SPECIES OF MACARANGA.

By MR. D. HOOPER, F.C.S., F.L.S.

INTRODUCTION.

An exudation which has been indiscriminately termed a gum and a resin has been frequently observed on the species of **Macaranga** growing in India and Burma. This genus of plants, belonging to the natural order EUPHORBIACEÆ, consists of about 80 species, all indigenous to the tropics. These trees or shrubs are not known to afford any important commercial or domestic products; the leaves of one or two species are employed as a green manure by Native agriculturists in Southern India, and the bark is astringent and might be useful as a tanning agent; but the timber even of the largest trees is white and soft and very liable to the attack of insects.

Macaranga Roxburghii.

The exudation about to be described in this paper is particularly noticeable in **Macaranga Roxburghii,** *Wight,* a tree of the Deccan Peninsula, and distinguished by **Sir Joseph Hooker** as "a small resinous tree" (*Fl. Br. Ind. Vol. V, p. 448*).

A resinous tree.

The young shoots and fruits are covered with an adhesive reddish secretion which has an odour of turpentine. It is also found on **M. indica,** *Wight,* widely distributed in the Eastern Himálaya and South India. **Colonel Heber Drury** describes the gum under the name of the latter plant. (*Useful*

MACARANGA Roxburghii.

A New Kino from Species of Macaranga.

MACARANGA INDICA.

Plants of India, p. 284.) "A gummy substance exudes from the cut branches and bases of the petioles of these trees. It is of a light crimson colour, and has been used for taking impressions of leaves, coins, and medallions. When the gum is pure and carefully prepared the impressions are as sharp as those of sulphur without its brittleness. This substance is very little known. Powdered and made into a paste it is reckoned a good external application for venereal sores."

M tomentosa.

Travancore.

Mr. T. F. Bourdillon, Conservator of Forests for Travancore, confirms the occurrence of this secretion in referring to the properties and uses of **Macaranga tomentosa,** *Wight,* a tree which is synonymous with **M. Roxburghii,** *Wight.* He says in "*Trees of the Travancore Forests,*" "The fruit is covered with a sticky juice and a gum exudes from the stem which is used medicinally and for taking impressions." **Dr. M. C. Cooke** reporting on the gums and resins in the Indian Museum in 1874, refers to a simple, pure gum of a crimson colour named *vutta thamaray* exhibited from Travancore and commented upon in the Madras Jury Report.

M. denticulata.

Sikkim.

This peculiar gum, however, is not confined to the trees of Southern India. **Mr. J. S. Gamble** describes its presence on two species of **Macaranga** found in Sikkim [*List of Trees, Shrubs, and large Climbers of the Darjeeling District* (1878), *p.* 71]. One of the species, **M. denticulata,** *Muell. Arg.* (**M. gummiflua,** *Muell. Arg.*) is said to be easily distinguished in the forests by its broad peltate leaves, and is known to the Paharis by the name of "Jogi Mallata." **Mr. Gamble** says, "A copious red clear gum exudes wherever a branch, or even leaf, is cut." The other tree alluded to by **Mr. Gamble** is an undetermined species of **Macaranga** known to the Lepchas as "Sing-kung." Of this it is remarked, "The leaves are used by Lepchas to poison fish, and their juice is said to raise blisters if applied to the skin."

Lower Burma.

Kurz, the author of *Forest Flora of British Burma*, draws attention to the fact that **M. denticulata** exudes a "red resin" in Lower Burma, and that **M. indica** and **M. Tanarius** exude a similar red resin in the Andamans.

Madras.

The secretion from **Macaranga** trees is not obtainable in any large quantity. The Indian Museum possesses three small samples collected from different localities in the Madras Presidency and

A New Kino from Species of Macaranga. (*D. Hooper.*) MACARANGA Roxburghii.

Mysore, and they have sufficed for the following description and analysis of the drug.

SPECIMEN FROM MALABAR.

1. Gum from* Macaranga Roxburghii (*Reg. No. 8037*) *received from South Malabar.—The District Forest Officer in forwarding the specimen in 1896 stated that the collection was difficult and costly, and only a small quantity was procurable. The kino was in red coloured tears and masses of various shapes, the consistence was tough, and there was almost a complete absence of odour and taste. The elongated tears had a peculiar property not noticed in any other sample of gum or resin. They broke with a fibrous fracture, and on immersing one of the tears in water or spirit the outer coating dissolved and the fibres unravelled themselves like a piece of string and ultimately curled back from the apex to the base, so that each tear assumed a fantastic shape of a sea anemone or a dwarf palm. It yielded a deep claret colour to water or spirit.

Mysore.

2. Gum from* M. Roxburghii (*Reg. No. 8484*) *from the Forest Department, Mysore.—This sample was in hard, tough, agglutinated pieces of a dark brown colour, breaking with a shining ruby-red fracture. There was no taste or odour.

South Kanara.

3. Gum from* M. indica (*Reg. No. 10829*) *collected in South Kanara.—This was in flat masses of a dull black colour and breaking with a vitreous fracture exhibiting red and yellow coloured portions in the interior. Like the previous specimen it swelled in spirit and in water affording red solutions. Portions of bark and leaves were attached to the specimens.

Definition of word Kino.

On submitting these specimens of gum to the action of various solvents and chemical reagents it did not take long to discover that they belonged to a class of vegetable exudations known as kino. Kino is an astringent gum, and may consist of almost pure tannic acid as in the case of Malabar kino (**Pterocarpus Marsupium**) or be associated with an insoluble substance as in the case of the Palas tree kino (**Butea frondosa**). The product of the **Macaranga** tree more intimately resembles the latter drug in so far as it is only partially soluble in water. Kino flows from a tree as a blood-red liquid, and **Sir George Birdwood** has suggested a connection between the name and "carnis," in allusion to the *flesh*-coloured juice. *Kano* is a West African name applied to the secretion of **Pterocarpus erinaceus**. *Khane* is the Persian name for the drug, and *kinta* is one of the names in the North-West Provinces for **Butea** kino.

MACARANGA Roxburghii. **A New Kino from Species of Macaranga,**

SANSKRIT REFERENCE.

There is a Sanskrit saying in the *Brihat Samhita* of **Varaha Mihira** that "If blood should ooze out of trees there will be wars in the land." The word for blood is translated kino in the Madura edition of this work.

Analysis of samples.

The samples of **Macaranga** kino were boiled with alcohol until nothing more was dissolved. In this extract was determined the amount of tannic acid, and this was deducted from the total soluble matter. The usual estimates were made at the same time of the moisture at 100° C. and mineral matter. The following results were obtained :—

	Moisture.	Tannin.	Non-tanning sol. matter.	Insol. gum.	Ash.
1.	17·1	15·0	2·35	63·45	2·1
2.	18·3	15·2	4·65	58·25	3·6
3.	16·5	6·65	3·55	70·95	2·35

Reactions of tannic acid.

The tannic acid in the spirituous extract was dissolved in warm water, and after the separation of a little flocculent matter as the solution cooled, the filtered liquor was tested with the following reagents :—

Ferric chloride	=	Purplish colour and precipitate.
Ferrous sulphate	=	No reaction.
Lime water	=	Olive-brown precipitate.
Ammonia	=	Dark-brown solution.
Caustic soda	=	Green colour turning brown.
Bromine water	=	Flocculent reddish precipitate.
Lead acetate	=	Greyish precipitate.
Uranium acetate	=	Reddish brown precipitate.
Gelatine in salt	=	Pink precipitate.

Heated with Hydrochloric acid for six hours, a small quantity of ether soluble crystals were obtained which struck a green colour with sodium hydroxide and a purplish colour with sulphuric acid.

This tannic acid differs from that found in other kinos in the reaction it affords with a ferric salt. Malabar and Bengal kinos give a green colour with this reagent.

The tannic acid, as already noticed, occurs in other parts of the tree. A sample of the leaves of **Macaranga Roxburghii** examined

A New Kino from Species of Macaranga. (*D. Hooper.*) MACARANGA Roxburghii.

in 1896 yielded 9·5 per cent., and the air-dried bark of a tree growing in the Nilgiri Hills gave 18·4 per cent. of a similar astringent principle. TANNIC ACID.

The insoluble gum peculiar to Macaranga kino is soluble to a large extent in dilute hydrochloric acid when heated for a few hours with that liquid, and therefore consists mainly of pararabin. Pararabin.

The characters of this kino are sufficiently marked to distinguish it from other similar exudations. **Pterocarpus** kino is practically soluble in water and in spirit, so that it is not likely to be confounded with this secretion. **Butea** kino bears a somewhat close resemblance both in appearance and solubility, but the fibrous nature of the tears; the larger masses of **Macaranga** gum and the different tannin reaction at once separate it. **Butea** kino, although tough in consistence, usually occurs in small flattened tears. **Macaranga** gum does not appear to belong to either of the three groups of Eucalyptus or Botany Bay kino classified by **Mr. J. H. Maiden**, of the Technological Museum, Sydney. Those of the "Ruby group" are soluble in water and in alcohol, although tough and difficult to powder. Those of the "Gummy group," although soluble in water, are scarcely dissolved by spirit, and are tougher than the former. The kinos of the third or "Turbid group" form turbid solutions in cold alcohol and water, and may be easily reduced to an impalpable powder. **Macaranga** kino has therefore, no resemblance to the Australian kinos, all of which are more or less readily soluble in water. Distinguishing features.

Dr. M. C. Cooke, in his Report on the Gums and Resins of India, classifies **Macaranga** gum under the heading of "Dark pseudo gums, β Insoluble in cold water, swelling and forming a pasty mass." Now that its composition and characters have been examined, it would be more appropriate to give it a position by the side of the **Butea** product, among the astringent gums or kinos. Its classification.

About four years ago **Dr. Schaer** of the University of Strassburg announced his discovery of a kino-yielding juice from **Myristica** species growing in Java. The publication of this fact caused a search to be made for a similar substance in the wild nutmeg trees in India, with the result that at least two species, one growing in Assam and the other in Sikkim, have been found to yield an identical secretion. The distinguishing feature of **Myristica** kino, as pointed out by **Dr. Schaer**, is the presence in the juice of crystals of calcium tartrate. (For further particulars see *Agricultural Ledger* No. 5 of 1900.) Myristica Kino.

MACARANGA Roxburghii. **A New Kino from Species of Macaranga.**

Summary of Kino-yielding plants.

A summary of the kino-yielding trees at present known, arrang according to their natural classification, will conclude the paper.

Commercial Name.	Leguminosæ.
The true or Malabar kino	**Pterocarpus Marsupiun** *Roxb.*
West African kino	**P. erinaceus,** *Poir.*
	P. indicus, *Willd.*
Bengal kino	**Butea frondosa,** *Roxb.*
	Ougeinia dalbergioides, *Bentl*
	Sesbania grandiflora *Pers*
Mashona land gum	**Brachystegia spicœfor mis,** *Benth.*
	Saxifragaceæ.
	Ceratopetalum gummi ferum, *Smith.*
	Myrtaceæ.
Botany Bay kino	**Eucalyptus sp.**
	Angophora lanceolata, *Cav*
	Polygonaceæ.
West Indian kino	**Coccoloba uvifera,** *Linn.*
	Myristicaceæ.
	Myristica sp.
	Euphorbiaceæ.
	Macaranga Roxburghii, *Wight.*
	M. indica, *Wight.*

M. 15-20.

G. I. C. P. O.—No. 2562 R. & A.—1-8-1900.—2230.—J. W. G

(Vegetable Product Series, No. 57.)
(Dyes and Tans.)

THE AGRICULTURAL LEDGER.

1900—No. 8.

TERMINALIA OLIVERI, *Brandis.*

(THAN.)

[*Dictionary of Economic Products, Vol. VI, Part IV*, T. 354a.]

THE BARK-EXTRACT (*THANSHA*) OF TERMINALIA OLIVERI AS A CUTCH SUBSTITUTE IN BURMA.

By MR. D. HOOPER, F.C.S., F.L.S.

Terminalia Oliveri, *Brandis. Hooker's Icones Plantarum, Section IV, Vol. III (1894), part I, t. 2212;* COMBRETACEÆ.

THE THAN TREE OF BURMA.

Vern.—*Than* (the tree); *thansha* (the extract), BURM.

Habitat.

Habitat.—A common tree in the dry region of the Irrawaddi Valley, in the lower part of the Chindwin Valley and near the head-waters of the Sitang Valley.

Uses of Than.

Than.—The bark of the Than tree has long been used as a substitute or adulterant of Burmese cutch, but on account of the employment of other deleterious additions to this tanning agent much confusion has existed with regard to the actual value of Than. The following opinions of Forest Officers will give the history of its use in Burma in cutch making :—

Opinion of Sir D. Brandis.

Sir Dietrich Brandis alludes to the bark in the following terms :— "The bark is thick and brittle ; its cells contain an abundance of starch, and calcium oxalate crystals but apparently no tannin. The decoction of the bark gives a light coloured extract which has been largely used to adulterate cutch (the extract of the heartwood of **Acacia**

USES OF THAN.

Catechu), but it is believed to be entirely ineffective as a tanning material."

Upper Burma.

Mr. J. W. Oliver says the practice of adulterating cutch with extract of *Than* bark is carried on in Upper Burma, but the bark is believed to contain neither catechin nor tannin. The extract is dark coloured, not light as noticed by **Brandis,** and when added in excess to cutch, it causes the latter to ferment, although a small quantity assists the cutch to set to a hard consistence.

Pakokko District.

Mr. A. Smythies refers to an imitation cutch being manufactured from *Than* bark in the Pakokko District. The addition of the extract imparts a light brown colour. The extract, which is known as *Thansha*, is alluded to in number 30 of the rules under the Upper Burma Forest Regulation and in Appendix XI. This substitute is not allowed to be made on Government land, and if the industry does exist, it is believed by **Mr. Smythies** to be only on a small scale, and confined to private lands. *Than* is a reserved tree in the Burma forests in order to control its felling.

Katha.

The Deputy Conservator of Forests for the Katha Division mentions the fact that *Thansha* is used by the fishermen along the Irrawaddi below Zigyaing where the tree is plentiful. The bark is boiled in an iron cauldron for about one hour and then removed and the nets steeped all night in the liquid.

Pyinmana.

The Deputy Conservator of Forests, Pyinmana Division, reported that the extract, called *Thansha*, is made to a small extent in Yamethin District. The product resembles cutch, and the local market price is about R8 to 10 per 100 viss.* A dye is also prepared by boiling the bark of the tree.

Mandalay.

The Conservator of Forests, Mandalay Division, reports that in his Division the pure extract of Than bark is not made, but the bark has been used to adulterate cutch by scraping it off the tree with a *dah* and mixing it with the chips of **Acacia Catechu** while being boiled in the earthen pots. The pure extract of **Terminalia Oliveri** slightly resembles cutch, but is of a brilliant colour, semi-transparent with very astringent properties. The bark of **T. pyrifolia** (*Sein*), **T. tomentosa** (*Taukkyan*), and **Odina Wodier** (*Nabe*) are also sometimes employed to adulterate cutch.

The nature of the locally made extract of Than bark might be gathered from the following paragraph from the Annual Report on the

* 1 viss = 3·65 lbs. Av.

EXAMINATION OF THAN BY DR. ROMANIS.

Laboratory of the Chemical Examiner, Burma, for the year ending 31st August 1888, by R. Romanis, Esq., D.Sc., F.C.S.

"***Forest products.***—These were specimens of cutch and 'Than,' a substance used in the adulteration of cutch. 'Than' contains no true leather-forming tannin, but it contains a red colouring matter not extracted by spirit, which in some of its reaction resembles tannin."

The residue insoluble in spirit is a gum, or mixture of gums, without action on polarized light. It is probably not of uniform composition, as "Than" appears to be a mixture of the extracts from several species of trees. Under some circumstances "Than" ferments and evolves gas.

"Than" may be detected in cutch by adding a solution of gelatin, and then adding alum to cause the precipitate to fall; if the cutch is pure, boiling water should extract nothing but a faint yellow colour from the precipitate; but if "Than" is present, a large quantity of dark red colouring matter is extracted.

The composition of "Than" is as follows:—

Composition.

Extracted by spirit	Resin	3·92
	Colouring matter	5·52
	Gum	14·60
Extracted by water	Gum, etc.	45·30
Residue	Moisture, sand, etc.	20·64

Preparation of Thansha.

Preparation of Thansha.

Mr. J. Nisbet, Conservator of Forests, Mandalay, when forwarding in September, 1897, a box full of *Than* extract (Reg. No. 10064), sent an account of the manufacture drawn up by Mr. Doveton who had prepared it under instructions of the Inspector General of Forests.

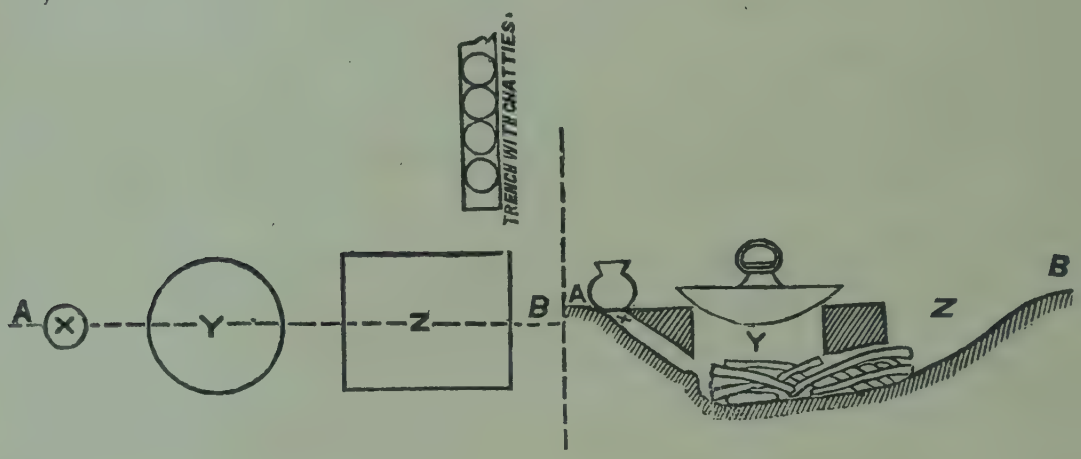
In the first place the bark has to be obtained from the tree. This is removed by means of a flat curved metal instrument, held at each end. The knife is one foot long with a sharp blade five inches long in the centre of the inner edge. With this instrument pieces of bark, varying from two to three inches in length, are scraped off the tree. Next, a trench has to be excavated along which the earthen pots containing the bark and water are placed and allowed to boil. The most suitable dimensions are 8′ × 8″ × 8″. Lastly, a fireplace has to be constructed

PREPARATION OF THANSHA.

a short distance from the trench for evaporating the extract. This oven looked at from above has three openings; the first (Z) being rectangular (3′ × 2′ 6″), the second circular, about 2′ 6″ in diameter, and the third (X) also circular but only 6 inches in diameter.

At the point (X) an earthen pot called the *yenio* is placed, at (Y) there is a large shallow metal cauldron for boiling the strained extract; (Z) is the opening where the fuel is supplied when necessary.

The accompanying diagrams will explain the positions.



Boiling the bark.

The earthen pots are each half filled with chips of the bark, and water is poured into them until they are three-quarters full. They are then placed in a row along the trench, and allowed to boil.

Shortly before the liquid from the earthen pots is poured off, the cauldron is heated over the oven, and the inside of it well smeared with linseed oil so as to prevent the extract from sticking.

After about three hours the liquid from the *chatties* is strained off, the *chatties* are half filled with water and the contents boiled again. The extract thus obtained is placed in the cauldron and boiled, any excess liquid being put into the *yenio* from which the cauldron may from time to time be fed.

In order to prevent the liquid from boiling over, an earthen *chattie*, with the bottom knocked out, is placed in the centre of the cauldron. As soon as the extract has acquired the right density, the cauldron is removed. The contents are then beaten into a froth by

means of a piece of wood somewhat resembling a small paddle, the object being partly to cool the liquid, but mainly to assist the extract in solidifying. PREPARATION OF THANSHA.

The outturn from 336 lbs. of chips of bark amounted to 49·8 lbs., equivalent to 14·8 per cent. The extract was of a soft consistence, but dried to a light brown brittle solid, easily reduced to powder. Outturn.

The Deputy Conservator of Forests, Mandalay, supplied 20 lbs. of the leaves of **Terminalia Oliveri** (Reg. No. 10247) in November, 1897, and in March, 1898, the same Officer sent 20 lbs. of the bark of the tree (Reg. No. 10586). Bark and Leaves.

Mr. H. C. Hill, Conservator of Western Circle, Upper Burma, sent in June, 1898, a further consignment of the extract (Reg. No. 11040). Extract.

With these materials at hand, received through the instructions of the Inspector General of Forests, the investigation was considerably furthered, and portions of each were sent to the Imperial Institute, Royal Garden, Kew, and by the Director of the latter institution to **Professor Procter**, Yorkshire College, Leeds.

Properties and Composition of Thansha.

The extract examined in the Economic Laboratory, Indian Museum, was somewhat soft with a dark red colour and astringent taste. It was almost entirely soluble in water and three-fourths were soluble with an acid reaction in rectified spirit. The solution gave a blue-black colour with salts of iron, an orange-brown precipitate with acetate of lead, and a pinkish deposit with gelatin. A bright steel blade left in contact with the liquid for a few moments became blackened. These tests point definitely to the presence of a tannin, of which it contained over 50 per cent., 25 per cent. of water was present in the fresh extract, but when sufficiently dried to powder, it contained 8·3 per cent. of moisture and 3·5 per cent. of ash. Properties of Thansha.

Professor Wyndham R. Dunstan, F.R.S., analysed a specimen of extract of **Terminalia Oliveri** (Reg. No. 10064) in the Laboratory of the Imperial Institute, London, with the following results :— Professor Dunstan's analysis.

Moisture	10·84
Tanning matter in dried material . . .	68·27

TERMINALIA Oliveri. **The Bark-Extract (*Thansha*) of Terminalia Oliveri**

ANALYSIS OF THAN.

Professor Dunstan remarks in his report, "Further information is required as to **Terminalia Oliveri,** of which the extract only was sent; this extract is rich in tannin. Very little seems to be known of this plant, at any rate under this name."

Professor H. R. Procter, in his recent work entitled "Leather Industries Laboratory Book," page 78, gives the following reactions for "Than leaf" extract, a cutch substitute (**Terminalia Oliveri**) :—

Ferric alum.	Bromine water.	$Cu SO_4$ and $NH_4 OH$	$H_2 SO_4$	Lime water.
Olive-black ppt.	Ppt.	Ppt. re-dissolves, brownish colouration.	Crimson, dilutes pink.	no. pp.

These reactions classify it with cutches from the wood of **Acacia-Catechu.**

Useless as a dye.

The Dyeing value of this extract was examined by **Professor Hummel,** of Leeds, who reported, "The appearance of this sample is similar to that of the last named sample (**Kandelia Rheedii.** When submitted to the test of calico printing, this extract gives very poor results; the colouring matter is much inferior to that of the extracts of **Ceriops Candolleana**), its dyeing power being very inferior. It has, therefore, no commercial value."

Bark and Leaves of T. Oliveri.

Professor Procter's analysis of the bark.

With regard to the leaves and bark of the Than tree, the samples were forwarded to **Professor Procter** who duly communicated the results of his analysis to **Sir W. T. Thiselton Dyer, K.C.M.G., C.I.E., F.R.S. Professor Procter** reported as follows :—

"I have to inform you that the following are the results of analysis of your sample of bark of **Terminalia Oliveri** (10586) marked 'from Mandalay,' according to the method of the International Association of Leather Trade Chemists :—

Tanning matter absorbed by hide . . .	31·1
Soluble non-tanning matter	10·2
Insoluble (at 60° Fah.)	48·4
Water	10·3

"This is apparently a valuable tanning material, but further experiments will be made when the College reopens."

T. 354a.

ANALYSIS OF THE BARK.

A proximate analysis of the bark made in the Economic Laboratory, Indian Museum, showed the following constituents :—

Wax and Resin (Ether sol.)	1·02
Tannin and col. matter (spirit sol.)	39·70
Water extract	7·70
Fibre	30·78
Ash	12·00
Moisture	8·80
	100·00

The tannin estimated in the spirit extract amounted to 25·4 per cent., a further quantity was also present in the water extract.

On the 7th April, 1899, **Professor Procter** addressed to **Sir W. T. Thiselton Dyer** the following report on the composition of Than leaves :—

Analysis of the leaves.

"I beg to inform you that the following are the results of analysis of your sample of leaves of **Terminalia Oliveri,** marked 'from Mandalay,' according to the method of the International Association of Leather Trade Chemists :—

Tanning matters absorbed by hide	14·4
Soluble non-tanning matters	12·2
Insoluble (at 60° Fah.)	64·5
Water	8·9
	100·0"

A proximate analysis of the same consignment of leaves was made in the Economic Laboratory, Indian Museum, with the following results :—

Wax and caoutchouc	8·74
Tannin and col. matter (spt. sol.)	22·70
Water extract	13·08
Fibre	41·33
Ash	7·95
Moisture	6·20
	100·00

The amount of tannin estimated in a decoction of the leaves was 14·5 per cent.

T. 354a.

CONCLUSIONS.

These analyses of authentic specimens of *Thansha*, and materia used in its manufacture, prove the superiority of the extract as tanning agent. The adulteration practised in Burma had evidentl given **Terminalia Oliveri** an evil reputation, which, we may hope will now be removed. The products of the *Than* tree should ran with the well known and largely used chebulic myrobalans the produc of an allied tree **(Terminalia Chebula).** The absence of red an brown colouring matters is a great advantage in recommending its us for tanning purposes at home and abroad, and is an essential requisit for manufacturing higher class leather.

G. I. C. P. O.—No. 2567 R. & A.—7-8-1900.—2,230.—J. W. G.

(Vegetable Product Series, No. 58.)
(Gums and Resins.)

THE

AGRICULTURAL LEDGER.

1900—No. 9.

BUCHANANIA LATIFOLIA.

(PIAL.)

[*Dictionary of Economic Products, Vol. I.*, B. 913-24.]

On PIAL or PEAL GUM.

A Report by PROFESSOR WYNDHAM R. DUNSTAN, F.R.S., *Director of the Scientific and Technical Department, Imperial Institute. To this has been added an abstract of the correspondence in the office of Reporter on Economic Products regarding the tree generally. The present paper may thus be described as a revision of the Dictionary article on* **Buchanania latifolia.**

If the investigation originated by Mr. J. S. Gamble into the gum of **Buchanania latifolia** has been more negative than otherwise in its results, it will nevertheless probably serve a useful purpose to make known the information collected in connection with the inquiry.

Those desiring further information regarding the oil of **Buchanania latifolia** are referred to Professor Dunstan's valuable report on Indian Edible Oils published in *The Agricultural Ledger* No. 12 of 1899.

Buchanania latifolia, *Roxb.; Fl. Br. Ind., II., 23; Ind. Kew., I., 349;* ANACARDIACEÆ.

Vern.—*Piyár, piyál, piyála, chironji* (the kernel), HIND., *Chironji, peal* (the fruit), *chirunji* (the kernel), *piyál, pial, pear* (the tree), BENG.; *Chirauli, chiráoli* (the fruit), *chironji,* PB.; *Piál, payála, muriá, katbhilawa,* GARHWAL; *Piár, peira, paira, paila, pairwa, perrah,* OUDH; *Tarum,* KOL.; *Pial,* BHUMIJ; *Peea,* KHARWAR; *Tarop,* SANTAL; *Charu, char, chara, charo,*

BUCHANANIA latifolia. **On Pial or Peal Gum.**

HABITAT.

URIYA; *Achár, chár, char-ka-jhar, chironji* (the fruit), *char-ka-gond* (the gum), C.P.; *Sáráka, surraka, herka, char-ka-gadh* (the gum), GOND; *Taro, tarope*, KURKU; *Sir*, BHIL; *Chár-ki-chároli* (the kernel), DUK.; *Piyal, chároli, chár, biji*, BOMB.; *Charwari*, HYDERABAD; *Char, chironji* (the fruit), BERAR; *Mowda* or *kalimango, marum, kal maá, aima, kátma-maram* (the plant), *kátma-payam* or *katma param* (the fruit), *katma-parpu* (the kernel), TAM.; *Chara, sara, charu mamudi, chiuna mora, morli morlu-banka, morlu-chettu, chára-chettu, cháru-chettu*, or *sára-chettu, chára-mámidi, járu-mámidi* (the plant), *chára-pandu* (the fruit), *chára-puppu, charu-pappu* (the kernel), TEL.; *Nuskul, murkalu, murukalu*, KAN.; *Kála maram*, MALA.; *Chároli*, GUJ., CUTCH; *Pyál-chár*, MAR.; *Piyála chára chirika*, SANS.; *Lonepho, lunbo, lamboben, lombo* or *lon-po, loneopomáa*, BURM.

References.—*Roxb. Fl. Ind. Ed. C. B. C., 365; Voigt, 272; Brandis For. Fl. 127; Gamble, Man. Timb., 109; Kurz, For. Fl. Burm. I., 307; Beddome, t. 165; Dalz. and Gibs. Bomb. Fl. 52; Stewarts' Pb. Pl., 45; Lisboas's Useful Pl. Bomb., 53; Drury's Us. Pl. Ind. 88.*

The major portion of the new information in this pamphlet has been derived from correspondence with the Forest Officers in the Provinces named.

Habitat.—A tree leafless only for a very short time. Found in the Sub-Himálayan tract from the Sutlej eastward, ascending to 2,000 feet; throughout India and Burma, common in the hotter and drier parts of the empire, and frequently associated with the *sál*, the *mahúa*, and the *dák*.

Bengal.—In Bengal the tree occurs in a wild state and is fairly common in *sál* forests of the Puri Division where it attains a height of 40 to 50 feet and a girth of about 5 feet. It is fit for cutting after 50 or 60 years. Seasons of flowering and fruiting, February-March. Not abundant in the Koderma forest, elevation 500—1,200 feet, where it grows along with *sál, mahúa, dhawa* and other species. Here it flowers February-March and fruits April-May.

Assam.—Forest Officers report that the tree is not found.

North-Western Provinces.—In the North-Western Provinces it is common in the forests of the Saharanpur Division at elevations up

On Pial or Peal Gum. (*W. R. Yates.*) **BUCHANANIA latifolia.**

HABITAT.

to 2,500 feet. An almost evergreen tree with dark green foliage. New leaves appear early in May. Reproduces freely by root suckers. Prefers a well-drained rather hygroscopic soil. The usual height to which it attains is 30-40 feet with a girth of 3 to 4 feet. It is also found plentifully in an uncultivated state in the Bhira range, Oudh, but in the other ranges of that circle it is met with only occasionally. The tree occurs in low-lying ground and in damp, clayey soils. It attains a height of 30-40 feet with girth up to 8 feet, and is fit for use at the age of about 40 years. It flowers January-February; the fruits ripen in April, but do not fall until the middle of June.

In the Bundelkhand Forest Division, Jhansi, the tree occurs abundantly in a wild state, chiefly on the dry stony plateaux, and attains a height of 30 to 40 feet with a girth of 40 inches. Seasons of flowering and fruiting February and May.

The Forest Officer, School Circle, reports the tree to be locally associated with the *sál* (**Shorea robusta**) and *sain* (**Terminalia tomentosa**). It prefers a dry soil. Trees 60 feet high and 6 feet girth are known, but trees of 30-40 feet high with girth 2 to 3 feet are more common.

Central Provinces.—Reports received from the Central Provinces indicate the tree as wild and fairly common in Betul Division. It avoids clayey soils and luxuriates in cleared lands at 3,000 feet above sea-level. The tree grows 30-35 feet high, the largest girth recorded being about 4 feet. Its longevity is from 50 to 60 years. Flowers from December to February, the fruits ripening April-May.

Wild in the forests of the Bhandara Division, the tree is said to be very common; its chief associates being *Mahua* (**Bassia latifolia**) and *Saj* (**Terminalia tomentosa**). Attains an average height of 30 feet, developes a broad, well-branched crown on a straight clean bole or stem which latter seldom exceeds 4 feet in girth. The tree first flowers and fruits at the age of about ten years. Seasons of flowering and fruiting January-February and April-May. Usually the fruit has fallen from the tree by the middle of June.

Found all over the Hoshangabad Division, chiefly in stony dry and sandy soils. Occurs wild, associated with *Saj*, *Dhaora*, *Mahwa* and *Teak*. Where the forest is dense, it is known to be as high as 40 feet, with girth 4-5 feet. The flowers appear in January; and the fruits begin to ripen in March, but are not mature till May.

BUCHANANIA latifolia. **On Pial or Peal Gum.**

HABITAT.

In the Nimar Division the tree is reported to occur over an area o about 800 square miles and more abundantly in the south and eas than elsewhere in the District. Wild but never cultivated, it prefer a rather rich light soil or the gravelly soil of disintegrated trap Attains a girth of 3 feet and height of 25 feet. The tree flower in February, the fruits set in March and ripen early in May; they ar gathered at once.

Narsinghpur Division.—Found in every part, especially in dr and stony soil. Occurs both on the plain of Narsinghpur and up t an altitude of 1,200 feet, being associated with *Mahwa*, *Teak*, an *Dhaura*. Girth 2-3 feet. In thick forest it reaches a height o about 40 feet, with girth of, say, 4 feet. Flowers appear in January fruits set in February, are formed in March and ripen abou May 15.

Panjab.—In the Panjab the tree is reported to be common in th Kalesar forest reserve, chiefly in the more elevated portions wit southern aspects. It grows to about 50 feet high and some $3\frac{1}{2}$ fee in girth. Occurs with the *sal* and is only worked out with the latte species. The tree flowers in March-April, and the fruit which fall almost immediately ripens in June.

Bombay.—It grows wild in the Poona Forest Division, occurrin sparsely in a few of the forests at altitudes of 1,500 to 3,000 feet Attains a height of 30 feet and a girth of 2 feet. Flowers January March, fruit ripens in April and May.

The tree is common in various parts of the West Khandesh Divi sion and occurs along with *mahwa*, *dák*, *sajadda*, and other such trees In this Division the season of flowering is reported to be Novembe and December.

Found wild in East Khandesh Division, is fairly scattered in th Satpuras up to 2,000 feet elevation, more abundant in the Satmall Range; its usual associates are *dhavda*, *moho*, *temru*, *salai*, etc. Th tree prefers a black soil, attains height up to 20 feet with girth o about 4 feet, flowers in February and fruits March-April.

Hyderabad Assigned Districts, *Berar*.—Reported to grow wil in abundance all over the province, flourishing on high lands and i poor soil. Flowers January-February and fruits April-June. I Amraoti it is wild and fairly abundant, especially in the Melghat, wit exception of the higher plateaux. Maximum height and girth observe

about 40 feet and 3 feet respectively. Fruit ripens at beginning of the hot weather. HABITAT.

Madras.—From enquiries made it appears the tree is not known to occur in the district of the Nilgiris.

Godavari District.—Common in the Bhadrachalam Taluk where it grows wild. Never cultivated. Flowers and fruits appear in February and March, the seeds being usually gathered in April.

The tree is reported not to occur in the South Coimbatore Forest Division.

Nellore District.—Occurs here and there in a wild state chiefly in the Rapur and Udayagiri Taluks. The tree flourishes in sandy soil near water courses, and attains a height from 15-25 feet with girth of $2\frac{1}{4}$ to 4 feet. Flowers appear September-October, the fruits ripening November-March. From April to June the leaves fall and new foliage appears July-August.

Found wild and in abundance in the Ganjam District at all elevations. Not cultivated. Seasons of flowering and fruiting, February-March and April-May. Mature at about 35 years of age, the tree commonly reaches a height of 40 feet, with girth of 3-4 feet.

In the Madura and Trichinopoly Districts the tree is reported not to be met with in any numbers.

Mysore.—Occurs sparsely in the Maidan jungles of the Hassan District. Not cultivated. It flourishes at altitudes of from 2,000 to 2,500 feet and where the rainfall is 25-40 inches. Greatest height observed 25-30 feet in Kolar, with girth 4 feet. In Hassan and parts of Bangalore the tree is of smaller dimensions—height 25-30 feet, girth 2 feet; height 10 feet, girth $1\frac{1}{2}$ feet.

Not found to any extent in the province of Coorg.

Burma.—Reported to be uncommon in the Western Circle, Mandalay, but abundant in the dry forests of the Mandalay Division, Eastern Circle, where it grows wild. Flourishes best near the edge of *Indaing* forests. Attains height of 35 feet with girth of over 4 feet. It flowers February-March and fruits March-April. Reported to be also plentiful in the Pyinmana Sub-Division. Here too it grows wild and attains a height of 30-40 feet with girth up to 6 feet. Flowers in March, fruits ripen April-May.

Properties and Uses.

Gum.—A pellucid gum exudes from wounds on the stem GUM.

BUCHANANIA latifolia. **On Pial or Peal Gum.**

GUM.

(*Brandis*), more than half soluble in water, and is reported to resemble *Bassora Gum*. (See **Bassora** and also **Cochlospermum.**) It occurs in irregular, broken fragments, brittle, pale, horn-coloured tinged with brown, tasteless, soluble in water, except a small insoluble portion of basorine. It has been pronounced as having adhesive properties similar to the inferior kinds of gum arabic, and as suitable for dressing textiles. The bark and the fruits furnish a natural varnish.

Bengal.—The Forest Officers report that the gum is called *Pial* but that is neither collected nor put to any use in their divisions. It is said to exude naturally from old trees, though not abundantly.

North-West Provinces.—Mr. Gamble, Conservator of Forests, School Circle, stated (No. 286, dated 29th June 1895) "at present the supply is limited, but if new markets could be found the supply could be greatly increased." The yield per tree is given as 1½ lbs. In the Kheri Division, Oudh, the gum exudes naturally from June-September. It is not collected. From a mature tree about 5 lbs. were gathered which had flowed naturally. Estimated cost at nearest railway station ₹12 per 100 lbs. Quantity available annually not known as the gum has never been exported. Report from the Pilibhit Division states the gum is not collected nor used, but that if trees were tapped possibly 150 or 200 maunds (or say, 100 to 150 cwts.) would be available annually, at a cost of ₹10 to ₹15 per 100 lbs. at nearest railway station. In the Saharanpur Division the gum is probably collected wherever found exuding naturally by those who lease the right to collect gums, but if so, it is mixed with other gums, chiefly **Odina Wodier**. The best season for collecting would be between February and May.

Cloth printing.

From Bundelkhand Forest Division, Jhansi, the gum is reported to be used in printing cloth. It exudes naturally in summer, the quantity yielded by each tree is not known but probably does not exceed ½ lb. The annual supply available is estimated at 2,000 lbs., but if tapping were employed the yield would, it is stated, probably increase 5-fold. Estimated cost ₹10 per 100 lbs. delivered at nearest railway station.

Central Provinces.—In the Betul Division, Central Provinces, the Forest Officer reports that the gum is collected and sold to the Banias or traders who export it after mixing it with the more valuable gum of

GUM.

Dhawra and *Saj*. Estimated yield per tree 2 lbs., price realised locally R4 to R8 per 100 lbs. Quantity annually available estimated at 200-300 maunds (say 150-230 cwts.). Report from Bhandara states the gum is occasionally collected and sold mixed with that of the *Dhawra* (**Anogeissus latifolia**). Yield per tree in the year stated to be ½ lb. Estimated quantity that could be collected annually 29 cwt.; cost delivered at nearest railway station per 100 lbs. R7-4. The Forest Officer, Hoshangabad Division, states that the annual yield of the gum per tree is from 2 to 10 tolas (·8 oz. to 4 oz.). From Khandwa it is learned that the gum is only occasionally collected and then only to adulterate more valuable gums. Some 35 cwts. (50 maunds) could be supplied if systematically collected. Cost of landing 100 lbs. of gum at nearest railway station about R15. The gum is obtained from October to May. In the Narsinghpur Division it is reported that the yield of gum from one tree in a year is 2 chittacks (4oz.) only. The gum begins to exude in the month of April as soon as the tree sheds its leaves.

Panjab.—The Deputy Conservator of Forests, Panjab, reports that the gum is not collected in his district. Should a demand arise, a good deal could be produced. Cost delivered at nearest railway station R7-8 to R10 per 100 lbs.

Bombay.—In the Poona Division the gum is stated to exude, from incisions made in the bark, in March and April. In West Khandesh the Forest Officer states a pellucid gum exudes from wounds on the stem. It is not collected nor used.

Berar.—From a report kindly furnished by the Officiating Director, Land Records and Agriculture, Hyderabad Assigned Districts, it is learned that in Berar no great value is set upon the gum and that no trade exists in it. A further report by the Officiating Conservator of Forests, Hyderabad Assigned Districts, states the gum is collected but not in any quantity, the price realised being 1½ to 2 annas per seer (2lbs.). It is said to be used in dyeing cloth. The gum is obtained in February and March.

Madras.—In the Godavari District the gum is obtained by incision in January-February.

In the Nellore District the annual yield per tree is stated to be 1lb. Total quantity available estimated at 100 lbs.

PROFESSOR DUNSTAN'S REPORT.

Report by Professor Wyndham R. Dunstan, F.R.S., ***Director of the Scientific Department of the Imperial Institute, on some Indian Gums.***

"The gums which have been examined are described in a letter from Dr. George Watt to Mr. Royle, dated the 2nd June, 1896, which enclosed a copy of a memorandum, No. 286, dated 29th June, 1895, from Mr. Gamble, Conservator of Forests, School Circle, North-West Provinces and Oudh, on the subject. Mr. Gamble stated that the local demand for the following gums, which are procurable in the forests of the Saharanpur Division, is not very good, and that it would be advantageous if new and better markets could be found for such products. At present the supply is limited, but if new markets could be found, the supply of certain kinds, especially those of *Pial*, could be greatly increased."

[The four gums contributed by Mr. Gamble and reported on by Professor Dunstan were as follows :—

Bauhinia retusa, Odina Wodier, Buchanania latifolia, and Boswelia serrata. The present review deals with only the third of that series, and the passages in Professor Dunstan's report that refer to the others will be excluded.—ED.]

Buchanania latifolia.

"The gum occurred in large irregular masses, tears, and small fragments. The fragments were clear and glassy, as also were the larger masses. The latter contained considerable quantities of impurity, in the shape of pieces of bark, etc., and the whole sample was contaminated with vegetable debris. The gum had little taste, and the fragments varied in colour from yellow to reddish brown. The amount of moisture present in the gum was 14·2 per cent., and the ash calculated from the dried gum amounted to 6·27 per cent. The gum was not entirely soluble when mixed with twice its weight of water, a portion swelling up, forming a gelatinous mass, which remained undissolved. When making the solution for the viscosity determination, the quantity of this insoluble portion was roughly estimated and found to be about 10 per cent. The mucilage obtained by treating the gum with twice its weight of water was thick, and possessed strong adhesive properties ; it behaved like ordinary gum arabic, contained no starch, but a small quantity of sugar was detected.

On Pial or Peal Gum. (*W. R. Dunstan*) BUCHANANIA latifolia.

PROFESSOR DUNSTAN'S REPORT.

Comparative determination of viscosity.

"The viscosity of the solutions yielded by these gums compared with that of a solution of the best gum arabic, was approximately determined by noting the time taken by 50 c. c. of a 10 per cent. solution to run from a burette fitted with a fine jet. The following table gives the results obtained :—

	Strength.	Burette time in seconds.
Gum arabic	10 per cent.	78
Odina Wodier . . .	10 per cent.	58
Buchanania latifolia . .	10 per cent.	184
Bauhinia retusa . . .	5 per cent.	200

"It appears from these results that a solution of the gum from **Buchanania latifolia** is more than twice as viscous as gum arabic solution of the same strength.

"The only previously recorded examination of these gums seems to be that by Dr. Rideal in 1892 (Journal of the Society of Chemical Industry, Volume II), who was furnished with small samples by Professor Pedler of Calcutta. Although it is evident from the preliminary results recorded by Dr. Rideal that the gums examined by him were the same in origin as those now under notice, it is obvious that their quality is different and usually inferior. It is important that attention should be paid in the future to the exportation of gum of uniform quality.

Since the commercial value of the gums of the Acacia type must depend on other circumstances than those connected with their chemical properties, as, for example, colour, size, freedom from contamination with extraneous substances, etc., it was thought desirable to obtain the opinions of several of the best known London dealers in gums. They were each supplied with small representative samples of the three gums, and were asked to furnish a report on their probable commercial value. The four reports which have been received may be summarised as follows :—

"1. These brokers report that they consider **Buchanania latifolia** of small value, as large quantities of similar gums are received in this country from Persia. They are chiefly bought by Continental dealers, and are said to be treated by some special process and rendered soluble. Prices for these inferior gums are not large —from 10 to 20*s.* per hundredweight.

BUCHANANIA latifolia. **On Pial or Peal Gum.**

PROFESSOR DUNSTAN'S REPORT.

"2. The brokers report that there is on the English marke large quantity of all kinds of East Indian gums, which renders very difficult to dispose of inferior qualities. **Buchanania latifo** is described as a gum of inferior quality, only partially soluble, co taining a large quantity of extraneous matter. It might be use for cheap manufacturing purposes where the dark colour would n be detrimental. It is likely to fetch 20*s.* per hundredweight. The brokers remark that it is desirable, when introducing a new gum, ship it in large quantities of not less than, say, 5 tons, as Engli consumers will not trouble to substitute new gums unless they a certain of obtaining a constant supply of average quality.

"3. The brokers report **Buchanania latifolia** to be of litt value.

"4. **Buchanania latifolia** is stated to be too insoluble to be much value.

"It will be seen from these commercial reports that **Buchanani latifolia** might be worth exporting if greater care were taken in i collection, and especially if large quantities of slightly coloure fragments could be put on the market. One firm of brokers wh reported on the samples, offered to take charge and dispose of an consignments of these gums which may be sent to this country."

TAN.

Tan.—The bark is used in tanning.

OIL.

Oil.—The kernels of the fruit yield an oil called *chironji*, bu owing to their being so much prized as a sweetmeat when cooked this oil is rarely prepared. It is pale, straw-coloured, limpid, swee and wholesome. The kernels when broken readily yield this oil, 5 per cent. being obtained. (*Agri-Hort. Soc. Jour. Ind. XII, 346.*)

Central Provinces—Khandwa.—The Divisional Forest Office reports that nine seers (18 lbs.) of kernel were pressed and yielde 2½ seers (5 lbs.) of oil or 28 per cent. In the Narsinghpur Divisio (1890) 5 seers (10 lbs.) of kernel yielded in the ordinary oil press 1¼ seers (2½ lbs.) of oil or 25 per cent. Report from Nimar states—the kernel is full of oil which can be easily extracted in the country oi press. It is, however, not prepared in this district. Nine seers (18 lbs.) of kernel on being pressed yielded 2½ seers (5 lbs.) of oi or about 28 per cent. Experiments in the division 1¼ seers (2½— of oil were obtained from 5 seers (10 lbs.) of the kernels or at the rate of 25 per cent.

On Pial or Peal Gum. (*W. R. Yates.*) **BUCHANANIA latifolia.**

OIL.

Reports of Forest Officers confirm the statement already made in the *Dictionary, viz.*, that the oil is seldom expressed.

MEDICINE.

Medicine.—The gum is said to be administered in diarrhœa. The oil is used as a substitute for almond oil in native medicinal preparations and confectionery. It is also applied to glandular swellings of the neck. According to Dr. Irvine (*Medical Topography, Ajmir, 131*), the seed is very palatable and nutritious especially when roasted ; is used also in medicine and is considered heating. The fresh fruit is very agreeable. "The fruits are said to be sweet and laxative. They are used to relieve thirst, burning of the body and fever." (*Dr. U. C. Dutt, Serampur.*) "Used to improve the flavour of drugs in general." (*Surgeon W. Barren, Bhuj, Cutch.*)

North-West Provinces.—The sweetmeats made of the seeds are considered stimulating (*School Circle*). The kernel worked up into an ointment is used in skin diseases (*Jhansi*).

Veterinary.

Central Provinces.—The roots and leaves pounded and mixed with buttermilk are taken in cases of diarrhœa. The pounded leaves are given to cows after parturition to hasten contraction of the womb (*Bhandara*). The fruit is said to be used by hakims in tonic medicines and for applying to the tongue when inflamed or very hard (*Hoshangabad*). The fruit is employed medicinally (*Narsinghpur*). Used in medicines by hakims and is said to be stimulating. It is believed to cure pimples, prickly heat and itch (*Nimar*).

Bombay.—The kernel is employed as a tonic, being sometimes substituted for the almond (*West Khandesh*).

Berar.—Kernels eaten as a tonic, pounded and applied outwardly they are used as a remedy for itch ; also employed by women to remove spots and blemishes from the face. (*Director of Agriculture, Hyderabad Assigned Districts.*)

Madras.—The gum with goat's milk is given internally for intercostal pains (*Bhadrachallam, Godaveri District*). The seeds mixed with sugar or honey are considered nutritious. Hakims prepare an electuary from them (*Nellore*).

FOOD

Food.—"The kernel is a common substitute for almonds amongst the natives. It is largely used in sweetmeats. Its flavour is described as between that of the pistachio and the almond. It is eaten roasted with milk" (*Lisboa, Useful Plants of the Bombay Presidency, page 150*).

BUCHANANIA latifolia. **On Pial or Peal Gum.**

FOOD.

The FRUIT is eaten by the hill tribes of Central India. Havin first pounded them, along with the contained kernels, they dr them in the sun. As required, this is baked into a sort of brea and eaten.

"The forest tribes gather the seed and take out the kerne which they exchange for grain, salt and cloth. The kernel is a important article of trade, being largely used in native sweetmeat Oil is also extracted from it." (*Bomb. Gaz., VII., 37.*)

"The fruit is sold in Bombay under the name of *chára-bhúr* (*Surgeon-Major W. Dymock, Bombay.*)

Bengal.—"The ripe fruits are eaten and sweetmeats made of th kernels (*Koderma*). The fruits are eaten by Khonds and low clas Uriyas (*Puri*).

North-West Provinces.—The ripe seeds are often eaten (*Kher Oudh*). Fruit sometimes eaten (*Pilibhit*). The ripe fruits an kernels are eaten by those living near forests (*Saharanpur*). Th fruits are eaten largely, being deliciously sweet and slightly sub-acid The kernel is highly esteemed for making sweetmeats and sells fo about 2 seers (4 lbs.) per rupee (*Jhansi*).

Central Provinces.—The seeds are exported to Bombay. Locall they are used for confectionery (*Betul*). The kernel is an importan article of trade and is used largely in native sweetmeats (*Bhandara*) The fruit is used in making sweetmeats (*Hoshangabad*). The fru consists of a fleshy pulp inside which is a nut. The pulp eaten and has a sweetish sub-acid pleasant taste. The shell the nut is thick and hard and encloses the kernel called *chironj* The process of separating the shell from the kernel is a slo and laborious one. It is effected by grinding the nut lightly i a corn-grinding stone so as to split the shell. Wild tribes colle the ripe fruits and sell or barter it at the rate of $\frac{1}{4}$ anna per see The kernel is readily sold in the bazar at 8 annas per seer. Th *chironji* is largely used in confectionery and is sometimes eaten i a raw state. The kernel could be landed at the nearest railwa station at about R15 per 100 lbs. The annual normal supply estimated at 300 mds. (about 220 cwts.) (*Nimar*). The fruit is of fleshy pulp, is eaten and has a sweetish taste. The kernels are care fully removed by lightly grinding the seeds in a millstone. It i estimated that 15 mds. (about 10 cwts.) could be freely collecte

FOOD.

from the forest of this division, and carted to the nearest railway station at a total cost of R 15 per maund. The fruit is used in making confectionery (*Narsinghpur*).

Panjab.—The fruit and kernel are eaten (*Kalesar*).

Bombay.—The kernels, both raw and cooked, are used in confectionery. They are extracted by grinding the fruits. Two kinds of sweetmeats, called, respectively, *barfi* or *pedha* and *basundi*, are prepared with milk boiled with sugar. The first of these is semi-solid, the second of the consistency of paste—the kernels are inserted whole into the sweetmeat (*Poona*). The kernel is largely used in sweetmeats (*West Khandesh*). The kernels are eaten raw and are used in confectionery. The pericarp when nearly ripe is also eaten by the Bhils (*East Khandesh*).

Berar.—The fruits, *chironji*, are eaten as fruit merely—not as food. They are said to be very heating and unwholesome. The kernels are collected and sold at 3 to 4 annas a seer (2 lbs.) for confectionery purposes (*Hyderabad Assigned Districts*).

Madras.—The seeds are eaten as a delicacy, but as the labour of extracting the kernels is great the fruit is seldom collected (*Godaveri District*). The ripe fruits are gathered and trodden under foot to separate the seed from the soft outside pulp. They are then soaked in water to facilitate breaking the hard shell which contains the kernel. The seeds are used mixed with sugar or honey as being nutritious (*Nellore District*). The fruit and seeds are occasionally eaten by the hill tribes (*Ganjam*).

Mysore.—The fruits are eaten. The kernel which is sweet is rich in oil and is largely exported (*Hassan*).

FODDER.

Fodder.—In the Panjab the leaves are utilised as fodder for buffaloes (*Kalesar*).

Bombay.—The leaves are used for fodder (*West Khandesh*). Leaves useful for fodder in times of famine (*East Khandesh*).

DOMESTIC USES.

Domestic Uses.—In the Central Provinces spoons or ladles for cooking, plates, and legs of bedsteads, toys, footstools, etc., are made from the wood (*Betul, Bhandara*).

Bombay.—Wood used for making bedsteads (*East Khandesh*). The leaves are used by Hindus as dining plates (*Poona Division*).

TIMBER.

Timber.—As met with in Bengal the timber is very soft. Not used locally (*Koderma*). The wood is inferior. Usually employed

TIMBER.

as fuel, and occasionally for house posts, rafters and door frames. It soon rots in the ground. There is no trade in the timber nor any supply at present of mature trees (*Puri Division*).

North-West Provinces.—No trade exists in the timber as the wood is very inferior (*Kheri, Oudh*). Valueless as timber, and only removed as firewood with other species (*Pilibhit*). No trade exists for timber (*Saharanpur Division*). No trade in the wood which is soft and not durable (*Bundelkhand Division, Jhansi*). Wood soft of little use, seldom utilised in any form save firewood. Charcoal made from it is poor. No trade in the timber (*School Circle*).

Central Provinces.—Not valued as timber although it is used for making posts, planks of doors, door and window frames and bullock-yokes. No trade in the timber (*Betul Division*). Felled generally for firewood. Occasionally used for handles of ploughs, bullock-yokes, water troughs, boxes, door and window frames. No trade in the wood which is brittle and attacked by white ants (*Bhandara*). Quality very inferior. Not used for building purposes. Becomes very light when dry. No trade exists (*Hoshangabad*). Being a fruit tree it is not allowed to be cut. The wood, though light and tough when seasoned, is not used in the district (*Nimar*). Wood light and dry, of inferior quality. Not used for building purposes. There is no trade in it (*Narsinghpur*).

Panjab.—Very straight examples are sometimes worked out as tors, but the timber is not durable and stands little strain. Occasionally used for thatching poles. No trade (*Kalesar*).

Bombay.—Timber soft and easily attacked by white ants, seldom used. Present and prospective supply very small (*Poona Division*). The timber can be used for making boxes, bedsteads, etc. (*West Khandesh*). Owing to its usefulness as a fruit tree it is seldom cut down. Cart frames and poles are, however, sometimes made from the wood (*East Khandesh*).

Berar.—Timber not valued, being soft, weak, and quickly attacked by insects. Used for fuel only. Occasionally employed for building. No present trade exists. Moreover, felling the tree is prohibited on account of its fruit (*Hyderabad Assigned Districts*).

Madras.—Never cut as the timber is considered valueless (*Godaveri District*). Colour yellowish white, very soft and of good appearance when converted. Hardly used at all as it is very brittle.

On Pial or Peal Gum. (*W. R. Yates.*) BUCHANANIA latifolia.

TIMBER.

No trade exists (*Nellore District*). Apart from local consumption, there is no demand for the wood. Not valued as timber, but commonly used for bullock-yokes and for the soles of clogs for which its lightness renders it suitable (*Ganjam District*).

Mysore.—Timber hard and fine-grained, fit for turning purposes, largely cut down for firewood in the Bangalore District (*Hassan*). This report as to quality of the wood is noteworthy since it is directly opposed to the reports which precede it.

Burma.—Sometimes used for house posts, but is not distinguished from other hard jungle woods: it would never be employed where *thitya* (**Shorea obtusa**) or *ingyin* (**Pentacme siamensis**) could be easily had. It is estimated that 200 tons yearly could be delivered at points along the railway at about R15 per ton. No present trade in the timber (*Eastern Circle*).

G. I. C. P. O.—No. 2223 R. & A.—2-8-1900.—2230.—P. M. M.

(Vegetable Product Series, No. 59.)
(Gums and Resins.)

THE

AGRICULTURAL LEDGER.

1900—No. 10.

BOSWELLIA SERRATA.

(INDIAN OLIBANUM.)

[*Dictionary of Economic Products, Vol. I.*, B. 771-76.]

A Report by PROFESSOR WYNDHAM R. DUNSTAN, F.R.S., *Director of the Scientific and Technical Department, Imperial Institute, on the Gum-resin. To this has been added an abstract of the correspondence in the Office of Reporter on Economic Products regarding the tree generally. The present paper may thus be described as a revision of the Dictionary Article on Boswellia serrata.*

While the result of the inquiry into the subject of the gum-resin afforded by **Boswellia serrata** cannot be said to have disclosed any very important feature—it seems desirable to publish **Professor Wyndham Dunstan's** brief but useful report and to supplement that with all the available new information regarding the various economic products afforded by the tree. The present review may be said to be founded on the extensive correspondence in the office of Reporter on Economic Products.

Boswellia serrata, *Roxbr., ex Colebr. in Asiat. Res., ix., 379, t. 5; Fl. Br. Ind., I., 528; Ind., Kew. I., 326;* BURSERACEÆ.

Sometimes called THE INDIAN OLIBANUM TREE.

Syn.—B. THURIFEA, *Roxb. ex Flem.;* B. GLABRRA, *Roxb.;* B. THURIFERA, *Colebr.* (as in *Gamble's Manual of Timbers*); LIBANUS THURIFERA, *Colebr.*

Vern.—(The gum-resin) *Salhe, salhar, salei,* or *salai, sálga, sel-gónd, kundur, salpe, lubán,* HIND.; *Lubán, salai, kundro,* BENG.; *Saleya* LOHARDUGGA; *Salga,* SANTAL; *Anduku,*

BOSWELLIA serrata — **Indian Olibanum.**

HABITAT.

anduga, gúggar, dúmsal, KUMAON; *Sáleh, narkandru* (the gum), PB.; *Salla, bor-salei, ganga,* GOND.; *Silái,* or *salái* (at NAGPUR) C. P., *Salar,* ULWAR; *Salai, salga, guggula, sálaya-dhup, salaphali,* BOMB.; *Salaphali,* MAR.; *Kundur,* DUK.; *Dhúp, mukul salai, gugali,* GUJ.; *Saliya gugul,* CUTCH; *Salai,* BERAR; *Kungli, gúlúlu kundriham morada, kundrukkampishin, parangishambirani,* TAM.; *Parangi-sámbráni, anduga-pisunu, anduku, ándu,* TEL.; *Vella-kundírukam,* MAL.; *Chittu,* KAN.; *Salasi-niryása, sallaki, kunduru, guggulu,* SANS.; *Bastaj, kundur, lubán,* ARAB.; *Kundur,* PERS.; *Thabi-ben, thadi, gadi,* BURM.; *Kundrikam,* SINGH.

Habitat.—A moderate-sized gregarious tree of the intermediate, northern, and southern dry zones, Sub-Himálayan tract from the Sutlej to Nepal, the drier forests of Central India from Berar to Rajputana, and southward to the Deccan, the Circars, and the Konkan. Frequent on the eastern slopes of the Pegu Yomah and Martaban, Burma. (*Kurz.*)

North-West Provinces and Oudh.—The Conservator of Forests, School Circle, reports that the tree occurs in the Forests of the Saharanpur Division. Met with but not abundant in the Dehra Dún Division.

Panjab.—Found to the East of the Province on the low hills near the Jumna. The tree is met with in a wild state throughout the Kalesar forest on spurs and ridges. It is fairly abundant in some parts of the forest when it grows to a height of about 40 feet with girth of, say, 5 feet. It flowers in July-August and the fruits ripen in September. It also occurs in the Simla Forest Division.

Hyderabad Assigned Districts.—From a report furnished by the Director, Land Records and Agriculture, it is learned that the tree is found in abundance in Berar. Growing perfectly wild, no care is taken to propagate it outside the Forest area. The tree flourishes on rocky elevated ground in poor red soil. The Conservator of Forests, Hyderabad Assigned Districts, reports this tree as very abundant throughout the drier and less densely wooded forests of the Melghat. In the forests on the West and South of the Taluq it forms 90 per cent of the crop over large areas. The tree reproduces easily both by seed and coppice shoots, it also pollards well. The fruit ripens and falls in December and January. The tree reaches a height of 50-60 feet, with a girth of 3-4 feet.

Indian Olibanum. BOSWELLIA serrata.

GUM-RESIN.

Burma.—The Conservator of Forests, Western Circle, Mandalay, states that the tree is uncommon in his Circle. In the Pegu Forest Circle it occurs sparsely. Seasons of flowering and fruiting March-April and October. Two varieties of the tree are said to occur. These are locally termed male and female. The first is met with on hilly rocky ground. The second which bears larger leaves than the first is found in evergreen jungle. The tree is said to attain a height of 100-120 feet with girth up to 10 feet and over. Reported to be scarce in the Pyinmana Forests, Yamethin District (Eastern Circle), where, however, it grows wild attaining a height of 50 feet and girth of 8 feet. Flowers in March-April; fruits ripen in June. Enquiries made by the Conservator, Tennasserim Circle, failed to confirm the report of its occurrence in Martaban, West Salween Division. Attempts made by the Conservator of Forests, Western Circle, to procure specimens from the Minbu and Magwe Divisions of the Circle were equally unsuccessful.

Properties and Uses.

Gum-resin.—The gum-resin, *Sálai gugul*, occurs as a transparent golden yellow, semi-fluid substance, which slowly hardens with (?) time. **Moodeen Sheriff** says that when it is found in the soft massive form it is known as *Gandah ferozah;* in tears (? true olibanum) it is known as *kundur*. It is pungent, having a slightly aromatic taste and balsamic resinous odour. It becomes opaque when immersed in alcohol or in water, the proportion of resin to gum being much smaller than in frankincense. The opaque, soft, whitish mass produced by water when rubbed in a mortar forms an emulsion. Indian Olibanum is consumed almost entirely in Central and Northern India, and is never exported.

In the Upper Godavari it yields plentifully the resin Olibanum (*C. P. Gazetteer, 503*). A sweet-scented gum, "burnt in religious ceremonies and sometimes used to strengthen lime" in Rewa Kantha, Gujarát (*Bombay Gazetteer, VI., 13*). A very common tree on all trappean hills, conspicuous by its white and scaly bark. No such substance as frankincense is extracted from it in Khándesh. The gummy wood is, however, used for torches.

Sir J. D. Hooker, in his Himálayan Journals (Vol. I., 29), says that while travelling on the mountain tracts of Behar he came across a small forest of this tree near Belcuppé. The gum was flowing abundantly from the trunk very fragrant and transparent. **Dr. Irvine,** in his

GUM-RESIN.

Topography of Ajmer (*page 135*), says that the tree is very plentiful in the Ajmer hills. The *gundabirosa* is the prepared gum-resin, and is similar in appearance and qualities to Venice turpentine. It is brought from Mewar, Harowtee, and the Shekhawattee hills, and is considered stimulating. An oil is distilled from it said to cure gonorrhœa. The gum-resin is also made into ointment. It is much used in painting especially by the *lakheries* men who paint with coloured lac (?).

Care must be taken not to confuse this gum-resin with the Olibanum or Frankincense of Commerce, or with **Mukul** (see **Boswellia sp.** and **Balsamodendron Mukul**). The Sanskrit name *Kunduru*, derived from the Arabic word *Kundur*, is most probably wrongly applied to the gum-resin of this species. It should be restricted to frankincense, a substance which reaches India from Arabia and Africa. The true Sanskrit name for the plant is most probably *Sallaki* from which is derived the Hindi word *Salai*. It would also appear that this is the *Guggulu* of Sanskrit writers, which is described as moist, viscid, fragrant, and of golden colour when freshly exuded. Gum-gugul of the present day is Indian Bdellium **(Balsamodendron Mukul)**. (*Surgeon-Major Dymock*, *Mat. Med., W. Ind., 123.*)

The gum is said to be seldom, if ever, collected in the Dehra Dún District. The Conservator of Forests, Panjab, reports as follows :—

The gum-resin exudes on injury only. A horizontal cut, 2 inches deep, is made in the stem, and the gum which exudes in this cut and flows down the stem is subsequently collected. The gum may be gathered twice in the year : once in March from the incision made in the previous October and once again in June from incision made in March. The quantity annually afforded by each tree is not known exactly, but is estimated at about 2 lbs. The gum could be landed at the Jagadri Railway Station for, say, R7-8 per 100 lbs. It is thought the Kalisar Forest might possibly yield 2,000-3,000 lbs. of gum a year. In the Simla Forest Division the gum is said to exude from the trees in March or April. From Hyderabad Assigned Districts it is reported that the gum appears to exude from the tree only when the stem has been injured in some way. The best season for gathering the gum is August and September. The gum-resin is used to a very small extent in some process of dyeing cloth. From a report furnished by the Conservator of Forests, Pegu Circle,

Dyeing.

PROFESSOR DUNSTAN'S REPORT.

Burma, it is learned that the gum-resin exudes from the bark, due probably to some injury of the latter.

Report by Professor Wyndham R. Dunstan, F.R.S., ***Director of the Scientific and Technical Department of the Imperial Institute, on some Indian Gums.***

The gums which have been examined are described in a letter from **Dr. George Watt** to **Mr. Royle**, dated the 2nd June, 1896, which enclosed a copy of a memorandum, No. 286, dated 29th June, 1895, from **Mr. Gamble**, Conservator of Forests, School Circle, North-West Provinces and Oudh, on the subject. **Mr. Gamble** stated that the local demand for the following gums, which are procurable in the forests of the Saharanpur Division, is not very good, and that it would be advantageous if new and better markets could be found for such products. At present the supply is limited, but if new markets could be found, the supply of certain kinds, especially these of Jingan and Pial, could be greatly increased.

[The four gums contributed by **Mr. Gamble** and reported on by **Professor Dunstan** were as follows:—**Bauhinia retusa, Odina wodier, Buchanania latifolia,** and **Boswellia serrata.** The present review deals with only the last of that series and the passages in **Professor Dunstan's** report that refer to the others will be excluded. *Ed.*]

Boswellia serrata.

This is a gum of an entirely different class. It closely resembles frankincense in its chemical properties. There is little demand for such a product in this country, but it might find a market on the Continent as an ingredient for incense.

* * * *

Medicine.—Very little of a definite nature is known of the medicinal virtues of this gum. It is probable that all that has been written on the subject should be considered as applying exclusively to imported Olibanum. **Dr. Dymock** says that the *Guggulu* of the Sanskrits was regarded as a demulcent, aperient, alterative, and a purifier of the blood. The gum at the present day is used in rheumatism, nervous diseases, scrofulous affections, urinary disorders, and skin diseases

BOSWELLIA serrata. **Indian Olibanum.**

MEDICINE.

and is generally combined with aromatics. It is regarded diaphoretic and astringent, and is used in the preparation of ointmen sores. It is also prescribed with clarified butter in syphilitic disea with cocoanut oil for sores, and as a stimulant in pulmonary dis Mixed with gum acacia it is used as a corrective for foul breath; t for any length of time in ℥i doses it is said to reduce obesity.

Special Opinions.—"The gum-resin is used to promote absorption of bubo, and is applied locally. The oil in 10 or 20 m doses is useful in gonorrhœa, taken in emulcent drinks." (*Sur C. M. Russell, Sarun, Bengal.*) "Refrigerant, diuretic, emmenago and clolic; doses 5 to 40 grains, used in aphthæ, placenta pr amenorrhœa, dysmenorrhœa, sore nipple, gonorrhœa, ringwor (*Choona Lall, Hospital Assistant, Jubbulpore.*) "Astringent, app in the form of an ointment to chronic ulcers, diseased bones, bub etc." (*Surgeon W. Barren, Bhuj, Cutch.*)

The gum is said to be used by natives for making healing ment. (*Deputy Conservator of Forests, Panjab.*) The gum-resi said to be used in cases of small-pox, the smoke of the burnt g having a beneficial effect. (*Conservator of Forests, Hydera Assigned Districts.*)

Food.—"The flowers and seed-nut are eaten by the Bhi (*Bombay Gazetteer, XII., 27.*)

The fruit is said to be eaten. (*Conservator of Forests, Hydera Assigned Districts.*) The fruits are eatable and have an acid ta (*Deputy Conservator of Forests, Pegu Division.*)

Structure of the Wood.—Wood rough, white when fresh darkening on exposure, moderately hard. It is not durable, bu has been reported that five sleepers made of it and soaked for s time in a tank filled with the leaves of *Bahera* (**Terminalia beleri** put down in June 1876 on the Holkar and Neemuch State Rail are still (1881) perfectly sound and good. (*Indore Forest Rep 1876-77*, quoted in *Indian Agriculturist* of May 1898.) The tim is recommended for tea-boxes. (*Indian Forester, IX., 377.*)

It is used for fuel and for making charcoal, which in Nima employed for iron-smelting. This "is a common, and thou not very large, a very beautiful tree (in Panch Mahâls). Its nar pointed leaflets and drooping branches give it something the look the English garden acacia. Its grey flakey bark is noticeable.

Indian Olibanum. BOSWELLIA serrata.

TIMBER.

yields a cheap resin, and besides for fuel, its wood is used in making platters." (*Bombay Gazetteer, III, 199.*) The wood which is weak and soft is used for fuel only. (*Director, Land Records and Agriculture, Hyderabad Assigned Districts.*) Timber soft, weak, easily perishable and very liable to be attacked by insects. Used to some extent for making doors and shutters. Also employed in the manufacture of bowls and dishes. The timber is said to be sometimes dyed yellow and sold as Haldu. Dead trees are largely exported for fuel and a considerable amount of charcoal is reported to be made from the wood of this tree. The price obtained for the timber is said to be about one-fourth of that paid for *Dhasra* or *Sajar* [? **Lagerstrœmia parviflora**] poles; (*Conservator of Forests, Hyderabad Assigned Districts, Amraoti.*) The evergreen jungle grown timber locally known as the female variety, *vide supra*, is much larger than that termed the male, occasionally attaining a girth up to 15 feet: the wood is redder and softer, and does not float. The hill-grown timber is smaller but hard and durable. It is used for boat-hulls as it floats when dried. In its hardness the wood resembles *Thitka*.

In the Paunglia Range it is worked out to Hlegu Revenue Station to a small extent for use as hulls of boats. A log 18 feet long by 6 feet girth is sold there for about seven rupees. On the Zamayi side it is worked out to a slight extent to Pegu town mixed up with other unreserved woods for use as planking. A log measuring 18 feet by 6 feet sells for about ten rupees.

G. I. C. P. O.—No. 2297 R. & A.—7-8-1900.—2,230.—J. W. G.

(Agricultural Series, No. 31.)
(Spices and Condiments.)

THE AGRICULTURAL LEDGER.

1900—No. 11.

ELETTARIA CARDAMOMUM.

(LESSER CARDAMOM.)

[*Dictionary of Economic Products, Vol. III*, E. 151-165.]

CARDAMOM CULTIVATION IN THE BOMBAY PRESIDENCY.

A Note by J. W. MOLLISON, ESQ., M.R.A.C., *Deputy Director of Agriculture, Poona.*

The paper which follows has been reproduced from *The Bombay Bulletin* by the courtesy of the Survey Commissioner and Director, Land Records and Agriculture, Bombay.

In connection with the subject of cardamoms attention is here directed to Mr. Mollison's useful Note on "Manures used in Kánara Spice Gardens" given on pages 4—8 of *Agricultural Ledger* No. 3 of 1900.

This plant is indigenous in West and South India, and is found plentifully in the rich moist forest soils of Kánara, Mysore, Travancore, etc. It is a perennial herb. A full-grown healthy plant is six feet or more high. The leaves are lanceolate, narrow, long, and have rather long petioles. They grow somewhat like ginger from rhizomes. The inflorescence is a spike, and it grows on a scape or leafless stem which springs from the rhizomes. The scapes grow horizontally and spread over the surface of the ground. The fruit, which is the commercial product, is a three-celled triangular capsule, with a yellow white leathery covering which encloses numerous small black angular seeds. These have a fragrant taste and aromatic odour. The rhizome increases in size from year to year, and an old plant,

ELETTARIA cardamomum. **The Lesser Cardamom**

CARDAMOM CULTIVATION.

therefore, produces a larger number of flowering stems and lea than a young one. The leaves, etc., die down annually. New gro springs up. The plant can be propagated by subdivision of rhizomes or from seed.

The crop is extensively grown in the betel palm and pep gardens of the Sirsi and Siddápur tálukas of Kánara. It thri under the same conditions of soil, etc., as betel palms and pep but by preference is grown in a cool, very shady garden with kept continuously moist by favourable position. The essential c ditions for successful cultivation are—

(*a*) A soil of loam or clay-loam-consistence kept by favoura position moist, but not wet at all seasons.

(*b*) The garden should by its natural situation be protec from strong winds and shade trees should be provide

If rhizomes are used for propagating the crop they are subdivi and the subdivided portions planted with their leaves attached in The pits should be 18 inches square and deep and be refilled with excavated earth mixed with a good portion of leaf-manure. rhizome should be lightly covered with soil and on no account deeply buried. In Kánara the crop is chiefly raised from s The seeds are small, and therefore to secure even distribution in seed-bed should before sowing be mixed with fine ash. A v prepared seed-bed with smooth friable well-manured soil is requi The manure should be old and thoroughly decayed, so that it be crumbled into a fine powder. Manure of this class if freely mi with the upper soil, gives the degree of tilth most suitable for ge nating the small seeds. Leaf-manure is best. The seed when s should be lightly covered. A bed 8 feet by 4 feet requires abou tolas of seeds. Some authorities recommend that the seed be sowing should be artificially germinated in folds of cloth or fla kept moist, but not too wet. The seeds as soon as they have str should be shaken off the cloth on to the surface of the seed and lightly covered with fine soil. The seed, if sown the usual way, takes a considerable time to germinate—usu a month. The sowing season in Kánara is in Septem October. The beds require protection from sun or rain. can be accomplished by the shelter of a raised platform cove with branchwood. The platform should be three or four feet h

CARDAMOM CULTIVATION.

The shade and shelter thus afforded is beneficial during the whole period during which the seedlings occupy the seed-bed. The seed-beds can be sufficiently protected from rain by placing branchwood immediately over the surface. This is usually the only protection given if the seed-bed is otherwise naturally well sheltered. The leaves and branches of the *Nelli* **(Phyllanthus Emblica)** are considered best. The reason why they should be considered superior for the purpose is perhaps open to conjecture. It is confidently asserted by the cultivators that the leaves and branches of this tree and other trees common in the district prevent insect attack. The leaves, fruit, and bark of such trees contain tannic acid, astringent resins and essential oils,* and therefore it is possible and perhaps probable that the presence of branchwood and leaves in contact or close proximity to young seedlings may be poisonous or disagreeable to insect life and may deter insects from causing damage to young seedlings.

Seedlings if they come up thickly should be thinned out. The plants that are left should remain in the seed-bed for four or five months. The beds must in the meantime be kept moist. Rice-beds adjoining the garden are used sometimes as a nursery when the cardamoms are first transplanted. Water must be available. A series of narrow channels are cut in the rice-bed parallel to each other and 2 to $2\frac{1}{2}$ feet apart. The excavated soil is put on the spaces between the channels. Thus flat ridges and narrow channels are alternately formed. The cardamom seedlings are planted on the ridges, two rows on each and at a distance of 9 inches to 12 inches between plants. A *mandap* is erected about 5 feet high of light bamboo or other available material. Palm leaves are spread on and tied to the bamboos and these give sufficient shade and shelter. The irrigation water is, in the fair season, so distributed that it trickles through all the channels continuously. The ridges are thus kept sufficiently moist but not wet. In the monsoon the irrigation and drainage water must be directed as far as possible away from the nursery. The seedlings are kept in the nursery for fifteen to eighteen months. They are then about 4 feet high. Cardamoms are planted permanently in the garden at two seasons—from March to June or from September to October. They are

* It is doubtful if the Nelli contains any oil. Tannic acid is believed to be the chief constituent. Ed.

CARDAMOM CULTIVATION.

usually planted in the same lines as the betel palms and interme between two trees. Pits 18 inches square and 18 inches deep are Part of the excavated earth is returned to the pit mixed with leaf-ma the seedling is planted and the pit filled up nearly level with leaf-m ure, but the rhizome and roots should not be deeply planted. The le should be supported by one or two bands of plantain bast tied, i case of each plant, to a stout wooden stake securely fixed upright the ground. The leaves would otherwise be beaten down by wi rain. The soil of the Bharan round each cardamom plant shoul regularly dug and weeded. It is asserted that vegetation of any does not freely grow under cardamoms. Each plant gets leaf-ma in March and April annually if the supply is abundant, otherwise every second year.

Fruiting season.

The plants are in bearing the year after being planted, bu not yield much the first year. The flowers come somewhat ir larly in April and May. The fruit forms during June and July in heavy rain should be protected by a light covering of leaves branchwood. The capsules ripen irregularly, but mostly in tember and October. Those on one scape should be collect they ripen. They are ripe when they begin to change c from green to yellow, and at this time should be full and firm the capsules are left until fully ripe they split and shed the Each capsule should be severed from the scape and not plu A portion of stalk should be left on each capsule. If pluck pressure of the fingers may burst the fruit. The fruit when gat is dried in the sun for two or three days and then handrubb the sun to remove the dried calyx attached to the apex of each The drying should be gradual. Full exposure to the sun may the pods to split, and this damages the spice considerably. capsules lose during dryage considerable weight and bulk. are during exposure to the sun, to some extent, bleached. When dry the produce is sold to dealers. The price ranges from to ₹75 per maund of 48 seers, each of 20 tolas.

In a fully stocked betel-nut garden there can be 300 to 40 damom plants per acre. A well grown healthy plant may yie to ½ lb. of dry cardamoms. But on the average the outturn is less, often not over 4 tolas per plant. Light showers in Apri May are favourable to a good crop, but numerous risks atte cultivation of cardamoms.

E. 151-165.

CARDAMOM CULTIVATION.

Bleaching.

The dealers bleach the cardamoms for certain markets, also sort and pack the produce suitably. The water of a well at Háveri on the Southern Mahratta Railway (Dhárwár District) is supposed to have special virtues for bleaching and improving the flavour of cardamoms. Mr. E. C. Ozanne describes the various processes as under:—

"Water from the well is drawn and taken to a suitable room. A large earthenware vessel is filled with the water, into which pounded *antalkai* (the fruit of soap-nut, **Sapindus trifoliatus**) and *sikikai* (**Acacia concinna**) in the proportion of 2 lbs. of the former to ¼ lb. of the latter for about 5 gallons of the water are placed and well stirred. Another vessel contains a strong solution of common soap in the water of the well. The mixture containing 2 lbs. of pounded soap-nut and ¼ lb. of *sikikai* suffices for 5 maunds (1 maund = 26 lbs.) of cardamoms.

"Two women seated on tripods place a wide-mouthed earthenware vessel between them, the washing tub as it may be styled. Eight *lota*-fulls of the well water (a large supply of which is kept at hand) are poured into the tub and three *lota*-fulls of the soap-nut or *sikikai* mixture. The *lota* holds about one quart of water.

"The tub then receives a basketful of cardamoms weighing 10 lbs. The two women plunge their hands into the tub and stir vigorously for about one minute and then suddenly rest for about the same length of time, and again stir for another minute. A thick lather results. This completes the first washing. The cardamoms are baled out by hand and transferred to a basket, where they remain a few seconds till the water has drained off. The basketfull is received by two other women sitting on tripods with a washing tub between them. This tub contains 7 quarts of the pure water, 1 quart of the soap-nut and *sikikai* mixture, and one of the soap solution. The cardamoms are stirred as in the first washing with the same interval of rest and are baled out into another basket. When the water is drained off, the washed cardamoms are thrown on to a mat. The heap becomes large after a few hours' work. A woman is exclusively in charge of it and continually sprinkles the well water over it. She is relieved at night by another woman, who sprinkles the heap till morning, once every half hour.

"Next day when the sun has risen, the heap is carried to the flat roof of the house, and the cardamoms are spread on mats for

CARDAMOM CULTIVATION.

Bleaching and Starching.

four or five hours to dry. The next operation is to nip off the sl stalks. This is done by women sitting in the house. Each wor has a large pair of English scissors. She squats on the floor rests her right hand which holds the scissors on the floor and fe the scissors with her left hand. The pace at which this nipping done astonished me. The stalk is very small, and care must taken to cut it off without injury to the cardamom itself. I an old woman nip 90 cardamoms in one minute.

"This done the sorting begins. The small ill-shapen cardamo are separated and only the well-rounded ones packed for exp to distant markets. A woman sorts a maund per diem.

"I must now return to the first washing. The mixture in tub, after the first basketfull has been baled out, is replenished by or three quarts of the well water and a second basketfull wash The tub is then emptied and a fresh mixture made. The mixture the second washing also does duty for two basketfulls. The wom who wash the cardamoms are paid 3 annas per diem. An ordin wage is 1½ to 2 annas. The night-watcher receives 4 annas. T nipping is paid for by the piece at the rate of ½ anna per *padi* (*padis* = 1 maund = 26 lbs.). It is said that an expert can earn annas per diem. She must clip 13 lbs. therefore; all other hai employed are paid by the day at 2 annas.

"Besides this bleaching now-a-days cardamoms are starch Starching was first introduced at Sirsi where bleachers had recou to it, as they had to compete with the bleachers at Háveri, who w experts in the art of bleaching, and who had established their fa as such. The starched cardamoms look whiter than the ordin bleached cardamoms of Háveri, and the bleachers of Háveri ha therefore now taken to starching. The starch is prepared by poundi together rice, wheat, and country soap with buttermilk. The pa is dissolved in a sufficient quantity of water and the solution is spr kled over the cardamoms to be starched as they are being rubbed the hand."

Blight.

In the Kánara gardens a so-called disease has appeared in t cardamom crops within recent years and is undoubtedly now restri ing the cultivation. The affected plants do not present any par cular indications of disease. They simply become unthrifty. T leaves in parts become yellow and then these parts of the leaves with

CARDAMOM CULTIVATION.

Blight.

The effect is that the plants have no vigour of growth. These unhealthy appearances were first noticed locally, but now the disease, if disease it can be called, is present in many gardens and extends over a wide area. It may be taken as certain that the cardamom plant, like any other cultivated plant, degenerates when grown for long periods under precisely the same conditions of soil, climate, and without any change in methods of propagation or reproduction. The vigour of any cultivated plant can be renewed from time to time by change of soil, change of seed, by rotation with other crops, and by other regenerating influences. The Kánara cardamom crops have for a long period been grown without any changes in the system of manuring, propagation, and general cultivation, and I have little doubt but the diseased conditions referred to have been induced by these causes. Within recent years borers and grubs have caused considerable damage, and the cultivators assert as a reason that they have been prevented by forest conservation from using for leaf-mould the leaves and twigs of certain trees. These trees have astringent properties, and it may be true that leaf-mould made from such material would not likely harbour insect life. The grubs cut through the leaves at the base and also cut into the rhizomes. Some of these grubs are identical with the large fat ones which are so commonly found in old farm-yard manure. Such manure is commonly used for plants in pots, and if these grubs are present they invariably cut through and cut into the roots of potted plants. A gardener, if he sees a plant withering or unthrifty, removes it from the flower pot and looks for the grub and destroys it if found. I can suggest no other remedy. The fruit of cardamoms are said to be eaten by snakes, rats, and other vermin.

G. I. C. P. O.—No. 2358 R. & A.—3-8-1900.—2,230.—J. W. G.

THE AGRICULTURAL LEDGER.

1900—No. 12.

BAUHINIA RETUSA.

(GUM.)

[*Dictionary of Economic Products, Vol. I.*, B. 330-33.]

SEMLA GUM.

'eport on its Chemical Properties and Commercial Value by PROFESSOR WYNDHAM R. DUNSTAN, F.R.S., *Director of the Scientific and Technical Department of the Imperial Institute.*

While the examination, both chemical and commercial, of **Bauhi-a retusa** gum has not disclosed any important feature, it neverthe-s seems desirable to publish **Professor Dunstan's** useful and interest-; report. It is accordingly given along with such other particulars garding the tree as are at present to hand.

uhinia retusa, *Ham.; Fl. Br. Ind., II., 279; Gamble, 161; Ind. Kew. I.*, 281, LEGUMINOSÆ.

Syn.—B. EMARGINATA, *Wall.*; PHANERA RETUSA, *Benth.*

Vern.—*Kurál*, PB.; *Kandla, kanalla, kuayral, gwayral, kanlao, semla*, HIND.; *Laba*, KOL; *Twar*, ORAON.; *Katman*, KHARWAR; *Thaur*, GOND; *Kaimu*, LOHARDUGGA; *Tewar*, PALAMAU; *Nirpa*, TEL.

Habitat.—A moderate-sized deciduous tree of the North-West nálaya, from the Beas eastward, ascending to 4,500 feet; Simla, hwál, Kumaon, and Central India.

BAUHINIA retusa.

Semla Gum.

GUM.

Properties and Uses.

Gum.—It yields a clear gum called *Semla gónd*, almost exactly resembling gum arabic. It is eaten by the poorer classes, and is used to waterproof terraced roofs. **Roxburgh** says: "From wounds made in the bark a brownish mild gum is produced." It is used as a medicine either alone or in combination with other medicines. The annual export from Dehra Dún is about 2,500 maunds.

"Is used as an external application to sores. It is considered a an emmenagogue and diuretic by some native practitioners." (*Surgeon G. A. Emerson, Calcutta.*)

PROFESSOR DUNSTAN'S REPORT.

Report by* Professor Wyndham R. Dunstan, F.R.S., *Director of the Scientific and Technical Department of the Imperial Institute, on some Indian Gums.

"The gums which have been examined are described in a letter from **Dr. George Watt** to **Mr. Royle**, dated the 2nd June, 1895, which enclosed a copy of a memorandum, No. 286, dated 29th July 1895, from **Mr. Gamble**, Conservator of Forests, School Circle, North-West Provinces and Oudh, on the subject. **Mr. Gamble** states that the local demand for the following gums, which are procurable in the forests of the Saharanpur Division, is not very good, and that it would be advantageous if new and better markets could be found for such products. At present the supply is limited, but if fresh markets could be found, the supply of certain kinds, especially that of Jingan and Pial, could be greatly increased."

[The four gums contributed by **Mr. Gamble** and reported on by **Professor Dunstan** were as follows:—**Bauhinia retusa, Odina wodier, Buchanania latifolia,** and **Boswellia serrata.** The present review deals with only the last of that series and the passages in **Professor Dunstan's** report that refer to the others will be excluded.—*Ed.*]

Bauhinia retusa.

"The sample consisted of large grounded tears and irregular masses, together with small angular fragments. The tears were opaque, brittle, breaking with a vitreous fracture, and brown in colour. The fragments were translucent and varied in colour from yellow to brown. The taste was bland and mucilaginous, though the gum was not very soluble in the mouth. The percentage of moisture in

Semla Gum. (*W. R. Dunstan.*)

BAUHINIA retusa.

PROFESSOR DUNSTAN'S REPORT.

natural gum was 13·5, and of ash in the dried gum 3·18. When the gum was mixed with twice its weight of water, it swelled up, absorbing the whole of the water, and forming a stiff gelatinous mass. It absorbed in this way six or eight times its weight of water. A 10 per cent. solution, made for determining its comparative viscosity, yielded a thick mucilage which could not be manipulated. A 5 per cent. solution was therefore employed. Even with this amount o water, a considerable quantity of the gum remained insoluble, swelling up and forming a gelatinous mass. This jelly was removed by straining through muslin, and the viscosity of the mucilage determined. The solution gave the usual reactions of gum acacia and only very faintly reduced Fehling's solution. With iodine no colour was given, showing the absence of starch and dextrine. Though resembling gum arabic in some of its properties, this gum is more like tragacanth in its behaviour to water. It possesses considerable gelatinising power."

"***Comparative determinations of viscosity.***—The viscosity of the solutions yielded by these gums compared with that of a solution of the best gum arabic, was approximately determined by noting the time taken by 50 c. c. of a 10 per cent. solution to run from a burette fitted with a fine jet. In the case of the gum from **Bauhinia retusa** a 5 per cent. solution was employed. The following table gives the results obtained :—

	Strength.	Burette time in seconds.
Gum arabic . .	10 per cent.	78
Odina wodier . .	10 „	58
Buchanania latifolia .	10 „	184
Bauhinia retusa .	5 „	200

"It appears from these results that a solution of the gum from **Bauhinia retusa** is nearly eight times as viscous as gum arabic solution of the same strength."

"The only previously recorded examination of these gums seems to be that by **Dr. Rideal** in 1892 (*Journal of the Society of Chemical Industry*, Volume II.), who was furnished with small samples by **Professor Pedler** of Calcutta. Although it is evident from the preliminary results recorded by **Dr. Rideal** that the gums examined by him were the same in origin as those now under notice, it is obvious that their quality is different and usually inferior. It is important that

BAUHINIA retusa.

Semla Gum.

PROFESSOR DUNSTAN'S REPORT.

attention should be paid in the future to the exportation of gum of uniform quality."

"Since the commercial value of the gums of the Acacia type must depend on other circumstances than those connected with their chemical properties, as, for example, colour, size, freedom from contamination with extraneous substances, etc., it was thought desirable to obtain the opinions of several of the best known London dealers in gums. They were each supplied with small representative samples of the three gums, and were asked to furnish a report on their probable commercial value. The four reports which have been received may be summarised as follows :—

"1. These brokers report that they consider **Bauhinia retusa** of small value, as large quantities of similar gums are received in this country from Persia. They are chiefly bought by Continental dealers, and are said to be treated by some special process and rendered soluble. Prices for these inferior gums are not large,—from 10 to 20*s.* per hundredweight.

"2. The brokers report that there is on the English market a large quantity of all kinds of East Indian gums, which renders it very difficult to dispose of inferior qualities. With reference to **Bauhinia retusa,** it is remarked that this gum closely resembles Persian or Bassorah gum, but it is not considered to possess at the present time any commercial value. These brokers remark that it is desirable, when introducing a new gum, to ship it in large quantities of not less than, say, 5 tons, as English consumers will not trouble to substitute new gums unless they are certain of obtaining a constant supply of average quality.

"3. The brokers report that all the samples are of inferior quality. **Bauhinia retusa** is probably worth 15 to 20*s.* per hundredweight.

"4. **Bauhinia retusa** is an inferior gum worth about 10*s.* per hundredweight."

"One firm of brokers who reported on the samples, offered to take charge and dispose of any consignments of these gums which may be sent to this country."

Structure of the Wood.—Reddish white, with irregularly shaped darker masses near the centre, hard. Weight 58 lbs. per cubic foot. Not used.

B. 330-33.

G. I, C. P. O.—No. 2494 R. & A.—9-8-1900.—2,230.—B. N. D.

(Mineral and Metallic Series, No. 14.)

THE AGRICULTURAL LEDGER.

1900—No. 13.

SALT—CHLORIDE OF SODIUM.

(COMMON SALT.)

[*Dictionary of Economic Products, Vol. VI, Pt. II*, S. 602-80.]

THE SALT SUPPLY OF NORTHERN INDIA.

A Note by F. ASHTON, ESQ., *Deputy Commissioner, Northern India Salt Revenue. To this is added a short description, received from the Director, Land Records and Agriculture, of Salt Manufacture in Bengal.*

[The interesting information given in these pages was courteously placed at the Editor's disposal by the Commissioner, Northern India Salt Revenue, Agra, and the Director, Land Records and Agriculture, Bengal, respectively, for incorporation in *The Review of Mineral Production in India.*

It has been decided by the Government of India that in future *The Review* shall be brought out every five years, and that a statement showing figures of production shall take the place of the annual issue.

Since these particulars kindly furnished in response to the Editor's call for information cannot therefore appear in *The Review of Mineral Production* for some time to come, it accordingly seems desirable that the papers should in the meantime be issued in the form of an *Agricultural Ledger*.—ED.]

SALT. | **The Salt Supply of Northern India.**

RAJPUTANA.

The sources from which the salt supply of Northern India is obtained are situated in Rajputana and the Panjab.

RAJPUTANA.

Three salt sources are worked in Rajputana : (1) the Sambhar Salt Lake, (2) Pachbadra, and (3) Didwana. At all three of these, salt is obtained by the evaporation of brine under the influence of solar heat.

Sambhar Lake.

(*1*) ***The Sambhar Lake.***—This is the most important source and is the largest salt work in India. The lake is about 20 miles in length, with a breadth varying from 2 to 7 miles. It is about 60 miles in circumference and covers an area of about 90 square miles. It lies in latitude 26° 5′ and longitude 75° 5′ and at a height of about 1,208 feet above the level of the sea. The country surrounding it is sandy and sterile, with the Great Indian Desert to the westward. The more north-westerly of the spurs of the Aravalli Mountains intervene between the lake and the desert country, and this intervention has served to protect the depression of the lake from being filled up with blown desert sand.

The bed of the lake is composed of a fine, black, tenacious mud very soft at the surface, but gradually hardening at lower levels. It shelves gradually towards the centre, the fall in 3·27 miles being only 2·08 feet. The supply of water is derived from three rivers which empty themselves into the lake ; two from the Aravalli hills to the westward, and the third and largest from the country to the north. During the hot and cold seasons, these rivers are dry, with salt efflorescence covering their beds ; but during the annual rains they come down in flood and fill the lake to a depth of about four feet in the centre in a season of good rainfall. With this depth the whole of the lake bed is covered with water. The rainfall varies greatly ; during the past 10 years it has fluctuated between 40·81 inches and 10·95 inches per annum. Evaporation on the dry sandy country in which the lake is situate is extremely rapid, and in ordinary years the whole of the water which accumulates during the rainy season is evaporated during the succeeding dry months, leaving a crust of salt on the lake bed. Occasionally, after an exceptionally heavy rainfall, the lake contains water throughout the year.

The density of the lake brine varies with the annual accumulation of water. In a year of ordinary rainfall, it is about 3° Beaumé (the density of sea water) at the close of the rainy season ; occasionally

when the lake is very full, it is less; and during years of drought it is as much as 10° Beaumé.

The salt in the brine of the lake appears to be derived from two sources. The surrounding country is saline, and during the annual rainfall a considerable quantity of salt is washed into the lake in solution. The principal source of supply seems, however, to be subterranean. A stratum of salt brine underlies the bed of the lake at a depth of about 30 feet and under considerable pressure. Except during years of very heavy rainfall, the whole of the brine in the lake evaporates, leaving its bed exposed to fierce solar heat in a peculiarly dry atmosphere. But though this happens, the mud of the lake bed always remains soft and wet, even during years of most severe drought. This is probably owing to the evaporation of the subterranean brine, and the salt in that brine is in such case drawn upwards by capillary attraction and remains in the soft mud on the surface of the lake bed. When the lake again fills, the water is strongly agitated by violent winds which prevail, and much of the salt which has accumulated in the surface mud is probably taken up in solution. The visible supply of salt is thus periodically renewed.

Salt is obtained by three methods: (*a*) from walled enclosures, (*b*) from shallow solar evaporation pans constructed on the lake shore, and (*c*) from the bed of the lake.

(*a*) A walled enclosure is a salt work constructed in the bed of the lake, by enclosing a rectangular space, with an embankment from five to seven feet in height pitched with stone, in order to protect the interior from the main body of water in the lake. Within the enclosure, large solar evaporation pans are excavated to a depth of about eighteen inches, lake brine is run into these by gravitation to a depth of about twelve to sixteen inches, and evaporation by solar heat results in the production of salt, which forms in a crust from two to three inches in thickness on the bed of the pan. When ready for extraction, labourers enter the pan with baskets, the crust is broken up, and the salt, after being washed with brine, is carried to a storage platform and stored in oblong pyramids, with sides sloped to an angle of about 36 degrees, and each containing about 50,000 maunds. The salt produced is white and of very good quality. It forms in four-sided pyramids, lined with steppes, the length of the crystals varying from half an inch to as much as an inch in length. A walled enclosure permits of manufacture being carried on even when the lake is so full of brine that a

RAJPUTANA. Sambhar Lake.

sufficient area of the shore is not available for production by oth methods; during a year of drought the pans in it can be readily fill for a full crop before the scanty supply of brine in the lake recede towards its centre; and with properly excavated pans, the supply brine can be regulated and manufacture conducted in such a manne as to obtain the best description of salt the lake is capable of produc ing. There are at present eleven walled enclosures at the lake. Th sizes of their rectangles vary from 1,681 feet by 951 feet, to 4,150 fe by 1,446. The smallest enclosure contains 20 solar evaporation pans each 421 feet by 152 feet; and the largest 60 pans, each 670 feet b 200 feet. The smallest enclosure has an evaporating surface of 28·6 acres, and the largest 184·68 acres. The entire evaporating surface o the eleven enclosures covers an area of 735·79 acres. During a good manufacturing season, with all conditions entirely favourable, th production of the evaporating surface of these enclosures is abou 6,000 maunds an acre.

(*b*) When after the close of the rainy season, the brine of the lak begins to recede towards its centre, shallow solar evaporation pans about 100 feet in length by 50 feet in breadth, are made along th exposed line of the lake bed, by scraping aside the soft surface mud and enclosing the rectangles with ridges of about a foot in height. The brine is then lifted into these pans with the aid of slung baskets lined with skins and each worked by two men, and is kept at a depth of from three to four inches until a sufficiency of salt has precipitated. This salt is scraped up, placed in conical heaps near the pans, and is finally carried on carts and animals to storage grounds above high water-mark and there placed in heaps similar to those in which the salt of the walled enclosures is stored. During a favourable season from 4,000 to 5,000 of these pans are worked and occupy about 15 miles of the lake edge. The salt is white and of good quality, but the crystals are small owing to the shallow depth of brine in which they are formed.

(*c*) The salt obtained from the bed of the lake may be termed spontaneous salt. When the lake brine has reached a high specific gravity and is beginning to recede towards the lake centre, it is enclosed within sections of the lake bed by means of rough retaining walls from eighteen inches to two feet in height and breadth, built of double lines of stakes lined with grass (**Saccharum sara**)* and the space between filled with lake mud. The sections of the lake bed so enclosed are

* = S. arundinaceum.

RAJPUTANA.

Sambhar Lake.

situated within workable distance of the shore and where the retaining walls are not likely to be affected by the main body of water when this is agitated by storms and strong winds. The mud of the lake is as much as two feet or so in depth, even within a short distance of the shore, and is so soft that it is not practicable to collect salt in heaps except at places not far below high water-mark. Salt which forms in these enclosures has, therefore, to be carried by labourers in baskets to points on the shore where the ground is hard enough to admit of its being placed in heaps, and consequently it is not economical to work beyond a certain point in the lake bed, as the cost of carriage in head-loads increases in greater proportion than the distance traversed. Besides this, though the water in the lake is shallow, its extent is so large that it has considerable force when agitated by strong winds, and retaining walls built beyond a certain distance from the shore are liable to be swept away. When the salt of an enclosure is ready for removal, narrow pathways are made by placing layers of grass upon the mud and these are used by the labourers for entering the enclosure and leaving it with basket loads of salt. Within the enclosure, the men wade into the soft mud, carefully lift the crust of salt by placing their outspread fingers below it, and collect it in their baskets. The salt is then carried along the pathways to the nearest point where firm ground is available and is there collected in conical heaps. It is then carried on carts and animals to storage grounds above high water-marks, where it is stored in the same manner as the salt of the pans on the lake edge, in fact the grounds are used for the storage of both descriptions of salt. This spontaneous salt is of good quality, and the crystals are similar in shape and size to those obtained from the walled enclosures. During a favourable season, the sections of the lake bed enclosed in the manner described, cover in the aggregate an area of about six square miles.

From what has been said, it will have been noticed that the manufacture of salt at the Sambhar Lake is largely influenced by the annual rainfall ; and this is so, not only as regards quality, but also in respect of general distribution of production. Manufacture depends upon the quantity of water which accumulates in the lake during each rainy season, and this also influences the seasons of production. During a favourable year, manufacture commences during January or February and continues with great activity until the commencement of the next ensuing monsoon about the end of June or the beginning of July.

SALT.

RAJPUTANA

Sambhar Lake.

The Salt Supply of Northern India.

With a small accumulation of water, salt commences to for October or November and extraction of salt extends over on period. The following figures will illustrate the influence over the production of salt by the seasonal rainfall :—

	Outturn of walled enclosure.	Outturn of Lake edge pans.	Spontaneous Salt.	T
	Maunds.	*Maunds.*	*Maunds.*	*M*
1894-95	41,58,475	22,15,918	6,60,623	70
1895-96	35,82,543	9,26,514	6,20,247	57
1896-97	26,46,434	4,00,256	43,156	30
1897-98	16,00,126	1,84,009	47,494	18
1898-99	43,98,925	7,43,666	1,75,121	53

The rainfall of 1894-95 amounted to 27·22 inches, conditi favourable, and a large quantity of salt was collected. The fa three succeeding years was 15·63, 15·18, and 14·96, conditions more and more unfavourable in each year, and the outturn of influenced in proportion. During 1898-99, the fall amounted 10·95 inches, but it occurred in such a manner that the accun of brine was sufficient to yield a larger quantity of salt than the three preceding yearly periods. The average cost of pro and storage of Sambhar salt during 1898-99 amounted to 3·8 a maund, exclusive of the rent and royalty payable on account lease of the lake, and expenditure connected with supervision of facture. Including such items, the salt cost on an average 3 1·06 pies a maund.

There are great facilities for the removal of salt from th bhar Lake. The Sambhar branch of the Rajputana-Malwa runs from the town of Sambhar 5 miles across the eastern end lake to the village of Gudha, and then skirts the northern s the small town of Nawa, 10 miles further on. All of the enclosures and storage grounds are connected with the main sidings, and the aggregate length of these latter is about 15 The present price of Sambhar salt is 4 annas a maund, and the ing figures show the quantities sold during the past five years :

	Maunds.
1894-95	40,31,618
1895-96	37,15,774
1896-97	39,31,210
1897-98	41,03,440
1898-99	41,26,743

sit- he stock balance of salt at the lake at the close of 1898-99 we unted to maunds 43,24,074. RAJPUTANA.

is ***(2) Pachbadra.***—The source is situate about 40 miles to the m th-west of the city of Jodhpur, the capital of the State of Marwar sh Land of Death). It lies immediately on the edge of the Great ex an Desert and at a distance of about 10 miles to the west of the th ni (or Salt) river. The source lies at a height of 359 feet above p sea, and in a sandy valley about 12 miles in length, which runs be south-westerly direction from the desert to the Luni river, a stream be ch is dry except during the rainy season. Excavations have shown l t the valley is an ancient river bed, and that the level has been B sed gradually to a height of about 8½ feet by the accumulation of s t and blown sand. With the immense sand hills of the Desert a ntiguous to it to the west and north, the valley would have long li ce been overwhelmed with drift sand, but for the circumstance that re prevailing wind is from the south-west, in which direction the th untry is less sandy. The source occupies a section of the valley a out 5¾ miles in length by 1¾ miles in breadth. Under this area, r ine springs exist, and it is from this brine that salt is manufactured. t hese springs occur below the ancient river bed and at a depth of a out 11 feet below the present level of the valley. Pachbadra.

The method by which salt is obtained is peculiar. Pits of an c erage length of 230 feet and a breadth of 60 feet are dug to the n el of the brine springs, and become filled with brine to a d pth of about 3 feet. The longitudinal axis of the pits is from s uth-west to north-east, the direction of the prevailing south-west w ind, in view to facilitating evaporation, and as this proceeds, m ore brine flows into the pits, until in the course of about 2 years t ey become filled with precipitated salt. To promote crystallization a nd to encourage the growth of large crystals, branches of a thorny d esert shrub (**Lycium europæum**) are thrown into the brine i n the pits, when precipitation is about to commence. The density o f the brine varies from 20° Beaumé to saturation point (25° B eaumé). During May and June, the heat is intense, 122° in the s hade during some years, and in the dry desert atmosphere evapora- t ion is rapid. The annual rainfall at Pachbadra is scanty in quantity a nd erratic in distribution. The annual fall of 1897-98 and 1898-99 w as 13·36 and 11·69 inches, respectively. Manufacture is independent o f the rainfall, but timely rain in proper quantity increases the flow

SALT. **The Salt Supply of Northern India.**

RAJPUTANA. Pachbadra.

of the brine springs and prevents precipitation in the pits with desirable rapidity and the formation of salt in small crystals.

There are 265 pits in working order in the source, and the ave outturn of a pit is about 10,000 maunds every two years, or 5 maunds a year. When a pit is ready for extraction, the mass o in it is broken into with short heavy poles shod with iron, the th branches are removed and the salt obtained is stored in an ob pyramid on the edge of the pit. The salt of the source is of good quality. In some pits, it forms in perfect cubes about ha inch square, and the produce of all is white and superior. The are the property of the manufacturers, and the salt is purcha from them at the rate of one anna a maund. The following figu show the quantity of salt produced during the past five years :—

	Maunds.
1894-95	11,09,214
1895-96	7,10,185
1896-97	7,22,765
1897-98	4,96,718
1898-99	7,72,303

Owing to manufacture being uninfluenced by climatic conditio the production of salt from the pits is regulated by demand. Salt sold at 1 anna and 3 pies a maund, and the following figures sh the quantities disposed of during the past five years :—

	Maunds.
1894-95	8,39,818
1895-96	5,97,114
1896-97	6,43,102
1897-98	5,94,827
1898-99	7,70,574

At the close of 1898-99, there was a balance of maunds 2,45,9 of salt in store besides a large reserve in pits ready for extracti Pachbadra is on a branch of the Jodhpur-Bikaner Railway and s can be removed from it with facility to areas of consumption.

Didwana.

(3) Didwana.—This source is situated about 40 miles to north-west of the Sambhar Lake. It is surrounded by san desert country, and the nearest station on the Jodhpur-Bikaner R way is about 28 miles distant. The source lies in a valley whic apparently an ancient river bed running from north-east to sou

west. A section of the valley about 2 miles in length by 1 mile in breadth, has been protected from the sand of the desert drifting from the westward, by an isolated spur of the Aravalli hills which lies immediately to the west of it. The protected section of the valley has a bed of black, tenacious mud and is very saline. A small quantity of water collects in it during the rainy season, but this is rapidly evaporated, leaving a thin crust of salt in the centre.

Brine springs exist beneath the depression and the method of manufacture is to tap these by means of wells, and to produce salt by exposing the brine to solar heat in evaporation pans made in the mud of the source.

There are two clusters of salt factories :—one on the southern edge of the depression comprising 46 brine wells and 222 evaporation pans, and the other on the western edge with 7 brine wells and 25 evaporation pans. The brine springs lie about 12 feet below the bed of the depression, their flow is abundant and practically inexhaustible, and a depth of about 6 feet of brine is constantly maintained in the wells. The solar evaporation pans are on an average about 80 feet square.

The method of manufacture is extremely simple. The brine of the source is of very high specific gravity, in fact very near the saturation point, and salt forms in the channels as the brine is being run into the pans. A depth of from two to three inches of brine is maintained in a pan and, as salt forms, it is scraped up into ridges with a wooden instrument formed of a section of plank attached to a handle. This ridging of the salt is steadily carried on from the time precipitation commences until the crop is ready. It is necessary for the reason that the brine is of so high a specific gravity when it enters the pan, that salt deposits almost immediately and of course in very small crystals. By collecting the salt in ridges and moving these about in the brine, the size of the crystals is increased, and many of these are glued together into small lumps about the size of small marbles. The greater the care taken in manufacture, the larger the number of these agglomerations, which consist of a number of small cubes of salt adhering to each other. Manufacture at Didwana is quite uninfluenced by the rainfall, which is very scanty in the desert country in which the source is situate. The supply of brine is always abundant, it is always of high specific gravity, and manufacture can be carried on uninterruptedly for nine months of the year.

SALT. **The Salt Supply of Northern India.**

RAJPUTANA. Didwana.

But owing to the distance of the source from the railway, its is limited, and a sufficiency of salt to meet the demand can b duced in the space of two or three months.

When first produced, the salt is placed in conical heaps nea pans, and is then carried to storage grounds on the edge of the de sion and stored in oblong pyramids, each containing from 30,0 1,00,000 of maunds. The cost of manufacturing and storing th amounts on an average to about six pies a maund, and the follo figures show the quantities produced during the past five years :—

	Maunds.
1894-95	4,16,508
1895-96	6,13,820
1896-97	4,54,158
1897-98	2,07,450
1898-99	2,21,817

Salt is sold at 9 pies a maund, and the following figures s the quantities disposed of during the past five years :—

	Maunds.
1894-95	3,91,121
1895-96	3,64,678
1896-97	2,77,235
1897-98	2,78,403
1898-99	2,92,582

The carriage employed in removing the salt disposed at the sou during 1898-99, comprised 49,821 camels, 3,859 pack bullocks, 2, carts, and 5,645 donkeys. The stock balance of manufactured in hand at the close of the same year amounted to 4,70,468 maunds

THE PANJAB.

THE PANJAB.

Two descriptions of salt are produced in the Panjab :—(1) obtained by the solar evaporation of saline brine at the Sultan Salt-works, and (2) rock salt produced from mines and quarr (*a*) in the Salt Range, (*b*) in the Kohat District, and (*c*) in the Ma State.

(*1*) ***SULTANPUR SALT-WORKS.***—These are situa about 30 miles to the south-west of the city of Delhi and in Gurgaon and Rohtak Districts, and they are tapped by the Farakh gar branch of the Rajputana Railway.

The Salt Supply of Northern India. (*F. Ashton.*) SALT.

THE PANJAB.

Sultanpur.

The country in which the salt-works lie is sandy and undulating, and brine strata are met with at a number of localities scattered over about 15 square miles of country. The brine springs generally occur in the hollows between the undulations, but are sometimes found below the higher levels, and the depth at which they are met varies from 24 to 39 feet below the surface.

In 1867-68, there were 10 localities at which the brine springs were worked for the production of salt. At that time there were in all 390 salt factories in existence, at which 3,799 solar evaporation pans and 246 brine wells were in use. The yearly sales of salt at the works then averaged about $5\frac{1}{2}$ lakhs of maunds.

Though the salt of these works is white and clean, it contains only between 81 and 87 per cent. of sodic chloride, and the presence of a proportion of sodic sulphate renders it somewhat bitter to the taste. Before the extension of railways to the sources producing superior salt in Rajputana, their nearness to areas of consumption conduced to the prosperity of these works, as the salt produced on them could be sold at a rate much cheaper than salt brought from Rajputana by road over hundreds of miles of sandy and difficult country. But when the Rajputana sources were tapped by the Railway, the inferior salt of these works lost favour in the market and their trade gradually declined, until now the manufacture appears to be approaching the period of entire extinction. Salt is still made at six localities, but the number of factories has fallen to 42, the largest number at any one locality being 12 and the smallest number 2.

The method of manufacture is somewhat expensive. Owing to the depth of the brine below the surface and the sandy nature of the soil, the wells have to be lined with masonry and the brine has to be drawn up in leather bags with the aid of bullocks. The density of the brine varies from 2° to 3° Beaumé; it is generally of lower specific gravity than sea water.

Besides its brine well, a factory comprises a set of masonry pans for solar evaporation, each pan being on a lower level than the one above it, and each communicating with those above and below it. On being drawn from the well the brine is first run into the highest of the series of pans, and after being detained in it for a short period for evaporation, is run into the second, and so on until it enters the lowest pan of the set. On reaching this last the brine is about the saturation point and salt is allowed to deposit. When precipitation is complete

THE PANJAB.

Sultanpur.

the salt is scraped up, removed from the pan and stored in c heaps. It is then ready for sale. The following figures sh quantities manufactured during the past five years at these works

	Maunds.
1894-95	1,00,485
1895-96	1,19,392
1896-97	1,19,494
1897-98	68,485
1898-99	67,166

The salt is the property of the manufacturers and the rates at it is sold by them vary greatly according to quality and den During 1898-99, prices fluctuated between 9 pies and 8 annas a m but the great quantity was disposed of at rates between 2 annas a annas a maund. Sales during the past five years have bee follows :—

	Maunds.
1894-95	94,614
1895-96	1,08,133
1896-97	1,11,877
1897-98	80,030
1898-99	78,188

The salt of the works is disposed of as manufactured, and a close of 1898-99 there was only a small unsold balance of 2 maunds.

ROCK SALT.

The Salt Range.

(2) ROCK SALT:—

(a) Mines of the Salt Range.—This range extends for than 150 miles, from the right bank of the Jhelam river to the bank of the Indus, the latter river flowing through its western e mity. The origin of the salt deposits is doubtful, but the pres of a bed in the range, at a higher horizon and probably of Silu origin, appears to indicate that the salt must be of very an palœozoic date.

The salt deposits are very extensive, with seams of great th ness, and outcrops occur very numerously in the cliffs of the gc of the range and on the hill sides. The hills are aptly termed "Salt Range," as immense and exhaustible seams of salt und them.

Under the Sikh Government, salt used to be mined at a nu of places in the gorges of the range. The method of mining

ROCK SALT.

The Salt Range.

picturesque but dangerous. The whole of a seam of salt used to be excavated, leaving a series of dome-shaped roofs supported upon comparatively slender pillars of salt, and as the upper strata pressed on these pillars they were liable to crumble and give under the immense superincumbent weight. The present system of mining is based on scientific principles. The salt is excavated in a series of chambers 45 feet in breadth, the sections left untouched between the chambers being 25 feet in thickness. Under this system the subsidences which used to occur under the old system cannot happen. The mining is all done by pick and blast, water being used as a solvent of the salt, when driving blast holes.

At present, salt is mined at three localities, Khewra, Narpur, and Warcha, between the Jhelam and the Indus; and is quarried at Kalabagh, situate immediately on the right bank of the Indus.

Khewra.

KHEWRA.—The important Mayo mine is situate in the Khewra gorge. The mine hill rises to a height of 700 feet above the level of the gorge. Regular excavation has now reached an extreme height of 273 above, and a greatest depth of 130½ feet below, the level of the gorge bed. The seams of salt in this mine are very fine. The present supply of salt is being obtained from two seams, one being 250 feet and the other 120 feet in thickness. The salt is of the finest quality with from 96 to 98 per cent. of sodic chloride. Roughly the mine is about half a mile in length by a quarter of a mile in breadth. The workings of the mine are reached in a horizontal plane and the salt excavated is removed by means of a tramway, which brings the salt out of the mine and conveys it down the gorge to the railway terminus on the plain below. Measured from the mine mouth, the tramway lines within the mine cover a distance of about 7,000 feet. Excavation is paid for by cubic measurement, and the rate of payment is R3-15-2·34 per 100 maunds. A hundred cubic feet of salt is equivalent to 135 maunds. About 1,000 persons are employed in the mine. The following figures show the quantities of salt excavated in the mine during the past five years :—

	Maunds.
1894-95	17,19,269
1895-96	18,82,229
1896-97	18,36,868
1897-98	19,57,792
1898-99	18,36,104

SALT. | **The Salt Supply of Northern India.**

ROCK SALT.

The Salt Range. Khewra.

The salt is sold at the rate of 9 pies a maund, exclusive of t of carriage to the Depôt near the Railway terminus and th of the past five years have been as follows :—

	Maunds.
1894-95	15,96,895
1895-96	19,40,640
1896-97	18,40,229
1897-98	19,75,768
1898-99	20,21,712

Nurpur.

NURPUR.—This is a very small mine which is worked only f supply of salt to the population of the country in the imm neighbourhood. The mine is in a hill side within the gorge village of Nurpur in the Jhelam District. Excavation is paid f the rate of R3-12-0 per 100 maunds of salt sold, and the sale is 9 pies a maund. The sales of the past five years we follows :—

	Maunds.
1894-95	4,122
1895-96	4,486
1896-97	4,111
1897-98	4,465
1898-99	4,195

Warcha.

WARCHA.—This mine is situate in the hillside at the entr of the gorge of the village of Warcha in the Shahpur District. a small mine in which only about 100 persons are employed salt is conveyed to the mouth of the mine by the miners, an carried away thence by traders. The excavation is paid for at rate of R3-12-0 per 100 maunds of salt issued to the trade the sale price is 9 pies a maund. The mine is situated at a dist of nine miles from the Ganjial station on the Sind-Sagar Sectio the North-Western Railway. The salt is carried on camels t Ganjial Station for despatch to areas of consumption by rai and also to Shahpur for conveyance by boat down the river Jhe Sales during the past five years have been as follows :—

	Maunds.
1894-95	1,01,935
1895-96	85,198
1896-97	99,028
1897-98	73,512
1898-99	77,827

The Salt Supply of Northern India. (*F. Ashton.*) SALT.

ROCK SALT, The Salt Range. Kalabagh.

KALABAGH.—The salt quarries of this locality are on the slopes of a hill which stands near the town of Kalabagh in the Bannu District and on the right bank of the Indus. Seams of rock salt, many feet in thickness, are exposed on the slopes of this hill, and these are quarried by pick and blast. The salt obtained is conveyed by the miners on pack bullocks to a depôt on the bank of the river and is thence taken up and down the stream, or across it to the Mari terminus of the Sind-Sagar Section of the North-Western Railway for distribution over the country Cis-Indus.

Excavation and conveyance to the depôt on the river are paid for at the rate of R4-0-0 per 100 maunds of salt sold. The following figures show the sales of the past five years, the sale price being 9 pies, the same rate as at Warcha, Nurpur, and the Mayo mine :—

	Maunds.
1894-95	80,324
1895-96	93,152
1896-97	83,101
1897-98	1,04,254
1898-99	1,19,819

The total quantity of rock salt obtained by mining and quarrying in the Salt Range during the past five years is maunds 1,01,71,791, or an average output of maunds 20,34,358 a year.

Kohat.

(*b*) ***Kohat.***—The deposits of rock salt in this district are classed with the nummulitic beds immediately overlying them, but it is not certain that they are eocene. They may be said to be early tertiary and are more recent than those of the Salt Range.

The Kohat salt deposits are immensely large, and it has been estimated that they amount to over 150 millions of tons. At Bahadul Khel, a locality immediately on the border, there is, for example, exposed rock salt which exists over an area about 4 miles in length by a quarter of a mile in breadth, and in it some of the visible salt seams are over 1,000 feet in thickness. Kohat salt is of a grey colour and impure in appearance, but analysis has shown that it contains from 90 to 96 per cent. of sodic chloride. When pulverized, it appears as a white powder and loses its distinctive grey tint.

The method of obtaining the salt is by quarrying with pick and blast, from exposed salt seams. Quarries were worked at five localities down to 1897-98; but at present salt is excavated at only four,

ROCK SALT. Kohat.

one locality having been closed during the interval. The foll figures show the sales from the quarries during the past five year

	Maunds.
1894-95	5,91,497
1895-96	7,85,470
1896-97	4,96,170
1897-98	3,22,404
1898-99	4,62,375

The frontier war and the enhancement of the duty affecte trade and fluctuations appear in the yearly sales. The trade is recovering itself and returning to its normal course.

The cost of excavation is paid to the miners by the traders purchase the salt at the rate of about one anna a maund. Salt is in rough irregular fragments, but at two quarries, Bahadur Khel Kharrack, rectangular blocks are also in demand. These latter from five to six inches in thickness and from a foot upwards in le and breadth, and weigh from 15 seers to one maund. This shape f litates packing on animals for transport over rough mountain roads

Mandi.

(*c*) ***Mandi.***—This is a small Himálayan State lying north-eas the Kangra valley in the Panjab. Rock salt is found in it at localities, Guma and Drang, about 20 miles distant from each ot and on the main road from Palampur in the Kangra District, to Kulu valley.

The salt of the Mandi State appears to date back to the e tertiary and is therefore about the same age as the deposits of Kohat District, and more recent than the deposits of the Salt Ran The salt is dark, reddish grey in colour, and is somewhat impu analyses showing that it contains only from 66 to 73 per cent. of so chloride.

The salt is obtained by quarrying with pick and blast. At Gu the seam forms a section of the bed of a small ravine down whic small stream trickles. This water is sometimes used for cutting large fragments from the seam. At Drang the seam is found at bottom of a small valley, below the bed of a stream, and the quarry is downwards. Sales of Mandi salt during the past five years h been as follows :—

	Maunds.
1894-95	1,28,789
1895-96	1,37,331
1896-97	1,25,361
1897-98	1,24,632
1898-99	1,26,715

SALTPETRE SALT.

SALTPETRE SALT.

Saltpetre.

Saltpetre is produced in large quantities in Northern India and in he Province of Behar in Bengal. Owing to the presence of potash nd decaying organic matter being more abundant in towns and villages than elsewhere, the nitrous ferments show the greatest activity n the soil of such localities, and the profitable manufacture of saltpetre ecomes possible and is carried on. A proportion of sodic chloride s always present in the nitrous soil which is utilised, and this, when eparated from the saltpetre with which it is in mechanical admixture s termed "Saltpetre Salt." When first obtained from nitrous soil, altpetre is in an impure state, owing to the presence of earthy matter nd chloride of sodium and other salts, and it is termed "crude saltetre." This crude substance has to be purified before it is fit for xport, earthy matter being removed and foreign salts (sodic hloride particularly) eliminated as much as possible. This purification s effected in refineries, which are scattered over Northern India and ehar, and there are also a few in Calcutta. During 1898-99, there ere 36,997 crude saltpetre factories and 570 refineries in Northern ndia and Behar, and 13 refineries in Calcutta. The refineries tilised 9,83,694 maunds of crude saltpetre, and produced 5,55,790 naunds of the refined substance in a condition fit for export.

Saltpetre Salt.

Saltpetre Salt,—though white in colour, is not in favour with onsumers at many localities, as apart from its fineness of grain, it as a faint nitrous taste. When sale can be found for it, it is passed nto consumption on payment of excise duty; but when it cannot be isposed of in the market refiners destroy it in bond. The following gures show the quantities of saltpetre salt excised and destroyed in ond, during the past five years:—

	Quantity Excised.	Quantity Destroyed.	Total.
	Maunds.	*Maunds.*	*Maunds.*
1894-95	55,133	12,991	68,124
1895-96	72,025	16,919	88,944
1896-97	72,652	65,903	1,38,555
1897-98	71,521	67,522	1,39,043
1898-99	51,250	31,366	82,616

Production of salt is dependent upon the state of activity of the xport trade in saltpetre.

SALT. | The Salt Supply of Northern India.

AREAS of CONSUMPTION.

AREAS OF CONSUMPTION.

Northern India Salt.

Sambhar Salt.

SAMBHAR SALT.—The following figures show the distr of this salt during 1898-99 :—

	Maunds.
North-West Provinces and Oudh	28,80,562
The Panjab	2,68,725
Rajputana	5,33,643
Central India	2,21,615
Central Provinces	16,457
Bengal	3,925
TOTAL	39,24,927

Sambhar salt is in extensive use in the North-West Pro and Oudh, and the eastern districts of the Panjab. It is consum over Eastern and Southern Rajputana, and largely in Central Exports to the Central Provinces are small, as there it meets ch salt from Bombay. The small quantity sent to Bengal was fo sumption in the Province of Behar.

Pachbadra Salt.

PACHBADRA SALT.—The salt which issued from this s during 1898-99 was distributed as follows :—

	Maunds.
Rajputana	2,95,262
Central India	1,97,942
Central Provinces	1,03,931
North-West Provinces and Oudh	1,44,225
Bengal	300
TOTAL	7,41,660

Pachbadra salt is consumed throughout Western Rajputana, la in Central India, and to a considerable extent in the Central Prov It has recently entered the North-West Provinces and Oudh in some large quantity. The small quantity sent to Bengal was for cons tion in the Province of Behar.

Didwana Salt.

DIDWANA SALT.—The issues of this salt during 1898-99 distributed as follows :—

	Maunds.
The Panjab	2,13,783
Rajputana	78,299
TOTAL	2,92,082

AREAS of CONSUMPTION.

The main field for the consumption of this salt is the country in the Southern Panjab to the eastward of the river Sutlej, the districts bordering the desert country being the largest consumers. In Rajputana, the salt is largely consumed in the Jaipur, Jodhpur, and Bikaner States, and small quantities are sometimes sent to Bundi in Southern Rajputana. A small trade in this salt is sometimes carried on with the Mozuffernagar and Saharanpur Districts of the North-West Provinces.

Didwana Salt.

Sultanpur Salt.

SULTANPUR SALT.—The following figures show the distribution of this salt during 1898-99.

	Maunds.
The Panjab	1,979
North-West Provinces and Oudh . . .	75,858
TOTAL .	77,837

The principal areas of consumption of this salt are, the Dehra Dun District and the hills to the northward, and the Terai and the foot hills of the Himálayas from a little to the east of the Ganges river down to Sitapur and Kheri in Oudh.

Salt Range Salt.

SALT RANGE SALT.—The distribution of this salt for 1898-99 is shown below :—

	Maunds.
The Panjab, Kashmir, Sindh, and Baluchistan .	18,68,863
The North-West Provinces and Oudh, and Behar in Bengal	3,58,267
TOTAL .	22,27,130

This salt occupies the whole of the Cis-Indus Panjab, with the exception of the districts to the extreme east (occupied by Sambhar salt), a fringe of country bordering on the Bikaner desert (where Didwana salt is consumed), and hilly tracts in the direction of Kangra and to the northward of that valley (occupied by Mandi salt). It is consumed throughout Kashmir, and small quantities are sent to Sindh and Baluchistan. It is consumed to a considerable extent in the country east of the river Ghogra, and in the eastern districts of the North-West Provinces comprised within the Benares Revenue Division. And it is largely used in the Province of Behar in Bengal. These particulars relate to general consumption of the salt by the people as a condiment. Medicinally, and for religious purposes among Hindus, it is to be found everywhere in small quantities throughout Northern India.

SALT.

The Salt Supply of Northern India.

AREAS of CONSUMPTION.

Kohat Salt.

KOHAT SALT.—As this pays a lower duty than the rest of the s Northern India it is confined to the country Trans-Indus. during the year 1898-99 were distributed as follows :—

	Maunds.
The Panjab-Trans-Indus	3,23,805
Swat and Buner	98,149
Kabul	40,421
TOTAL	4,62,375

The city of Peshawar is the principal mart for this salt, ma 1,81,183 having been sent there during 1898-99. A conside proportion of the salt sent to Peshawar is exported across the b to meet the wants of the trans-border tribes.

Mandi Salt.

MANDI SALT.—The issues of 1898-99 were distributed as follow

	Maunds.
To Hill districts in British Territory	71,065
To Hill States	55,650
TOTAL	1,26,715

The salt is consumed in the British districts of Kangra (inclu its subdivision of Kulu) and Simla, and the Hill States which im it are Mandi, Suket, Bilaspur, Rampur-Bishahr, and Chamba.

Saltpetre Salt.

SALTPETRE SALT.—This is consumed locally in the Province which it is produced and often in the immediate neighbourh of the saltpetre refineries from which it is excised.

TRAFFIC in SALT.

TRAFFIC IN THE SALT OF NORTHERN INDIA.

The following statement shows the production of salt within area during the past five years :—

Northern India production of Salt.

	1894-95.	1895-96.	1896-97.	1897-98.	1898-
	Mds.	Mds.	Mds.	Mds.	Mds
Sambhar	36,45,568	40,21,752	40,42,153	40,56,180	39,24,
Pachbadra	5,98,102	5,94,357	6,79,753	5,98,102	7,41,
Didwana	3,47,713	3,61,465	2,78,556	2,78,278	2,92,
Sultanpur	95,118	1,08,129	1,11,376	79,393	77,
Salt Range	17,83,646	21,51,088	20,48,563	21,78,533	22,27,
Kohat	5,91,497	7,85,470	4,96,170	3,22,404	4,62,
Mandi	1,28,789	1,37,331	1,25,361	1,24,632	1,26,
Saltpetre Salt	55,133	72,025	72,652	71,521	51,
TOTAL	72,45,566	82 31,617	78,54,564	77,09,043	79,03,

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These figures represent actual issues of salt from sources of supply to areas of consumption.

BENGAL.

Presidency Division.

Presidency Division :—

24-Parganas.

24-PARGANAS.—Salt is manufactured in the southern thanas of the district of 24-Parganas comprising the Sunderbans. The soil is impregnated with salt and the tidal rivers which pass through the forest leave a rich deposit of saline earth at the time of the spring tide. The manufacture of salt is carried on from November to April. The manufacturers are the descendants of the Molanghis who used to make salt in these tracts when the manufacture was in the hands of Government. They are Hindus and Muhammadans of the lower order and are of a turbulent character. They are engaged in the manufacture for about 25 days in the month and they transport the product by boats, head-loads, etc. The operations not being warranted by law an officer was deputed in 1896 to investigate the extent to which the manufacture was carried on ; the following particulars have been taken from his report :—

There are two processes for the preparation of salt. The first is a simple method. The brine scraped off the earth is kept in an earthen pot mixed with saline water and another pot is placed underneath. The brine which filters through an aperture down to the pot below is boiled and salt is produced. In the second process, two pits of different dimensions connected by a drain are dug out at different levels. The upper pit is larger, but the lower pit is the deeper of the two. A cover of straw or leaves of trees is placed over the mouth of the larger pit, and on this layer of straw or leaves the saline earth is spread, saline water is then poured over it and a process of trampling under foot goes on in order to thoroughly mix the salt water with the saline earth. This being done, the connecting drain which is stopped up while the trampling is going on is now opened, and thus the salt water finds a ready passage through this drain to the lower pit. This *distilled* salt water, called the brine, produces salt when boiled. Four seers of brine produces a seer of salt. These pits serve the purpose of filters which vary in size, the diameter of the larger pit being generally 6 to 8 feet. Each filter produces brine for one furnace which is constructed close to it. The furnaces are made just like those used for

SALT. | The Salt Supply of Bengal.

BENGAL. Presidency Division. 24-Parganas

making molasses or *gur*. Two earthen walls parallel to each are raised from three to four feet apart, from four to five feet in h and from six to eight feet in length. The space between th walls is roofed over in the form of a dome with an admixture o mud and twigs. Circular openings varying in number from four are left in the domed roof and iron boilers are placed upon the ope of the furnaces, a brisk fire of fuel being kept up all the time bet the parallel walls. The salt deposited in the boilers is removed placed upon a heap of ashes to drain and dry.

The quantity of salt produced in the Sunderbans is roughly estim at 2,50,000 maunds (9,174 tons) per annum. Such a large qua is not all consumed locally. A portion of the product the exact qua of which remains to be ascertained, is carried to the neighbou districts of Khulna and Midnapore.

The salt produced by the second process is said to be almos good in colour and taste as the foreign salt which is brought t district from Calcutta and can be distinguished from the latte experts only. It is, however, sold at a cheaper rate, as the sale b unauthorized has to be conducted with secrecy.

Rajshahye Division Pabna.

Rajshaye Division :—

PABNA.—There is no production of salt here. The supply of sa of more than one kind, *viz.*, *Bit*, *Karkach*, *Sandhab*, *Khauri*, and Li pool. The last named is only for consumption and largely u *Karkach* and *Sandhab* too are consumed to a limited extent. *B* used in the preparation of specific medicines by native physicians. is also given to horses with their food occasionally. *Khauri* is used in tanning. All these varieties are imported from Calcu Except the Liverpool kind all the salts are Indian.

Orissa Division. Puri.

Orissa Division :—

PURI.—Salt used to be manufactured at the mouth of the I river and on the borders of the Chilka Lake. There was no ma facture near the Devi river during 1897-98, but in spite of the la stock of the commodity which had accumulated at the factories on Chilka, the total failure of the crops in tracts bordering on the having caused severe distress among the people, manufact there was ordered to be continued as a relief measure.

There was a great decrease in the sale of the salts manufactu in 1897-98, this decrease, the Collector explains, is due to the oper

The Salt Supply of Bengal. SALT.

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of the East Coast Railway for traffic. This no doubt permits of Madras salt being sold at a cheaper rate than Puri salt as the Madras factories are situated near the Railway line. Chilka salt is also said to be inferior in quality to that of Madras and not so clear. This too affected the sale periodically.

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THE AGRICULTURAL LEDGER.

1900—No. 14.

IRON.

[*Dictionary of Economic Products, Vol.* IV., I. 440-71.]

THE IRON INDUSTRY AS CARRIED ON IN BENGAL AND THE CENTRAL PROVINCES.

Extracts from the Reports on the subject furnished by Deputy Commissioners and Forest Officers.

It may be well to state that the particulars herein given have reference to the calendar year 1898. They were obtained with a view to their publication in the Review of Mineral Production in India for that year. The Government of India have, however, decided that in future the Review shall appear every fifth year and that the annual issue shall be replaced by a yearly statement showing figures of outturn only.

Under the circumstances it seems most desirable to issue the information in the present form of an *Agricultural Ledger*.

The Editor's acknowledgments are due to the Director of Agriculture, Bengal, and the Commissioner of Settlements and Agriculture, Central Provinces, respectively, for their kindness in placing the information at his disposal.

THE IRON INDUSTRY IN BENGAL.

BURDWAN DIVISION.

Burdwan.—There is only one Iron Factory, namely, the Barakar Iron Works, situated in the Raniganj Sub-Division, where pig-iron, as well as pipes and various kinds of castings are produced. It obtains the iron ore locally, partly in Raniganj and partly in the adjoining district of Manbhum. The ore is found generally on the surface or within a depth of five feet. The lime required at the Factor is imported from the Central Provinces.

IRON. | **The Iron Industry as carried on**

BENGAL.

BURDWAN DIVISION.

Traces of old furnaces on a very small scale with slag heaps in the Barakar neighbourhood, show that the iron ores had cer been worked before the iron works came into existence.

Excluding those who are employed in the production of coal, and lime, seven hundred people were engaged daily in collectin ores and bringing them to the works. In the smelting works be four and five hundred men and in the foundries twice that nu were daily employed.

The wages vary from six pice a day earned by the common c to one rupee or more earned by the skilled workmen.

Forty-one thousand three hundred and eighty-seven tons of iro were brought to the works at a cost of R97,741. The output of iron amounted to 19,720 tons valued at R9,44,073 and the m factured castings amounted to 7,833 tons valued at R6,33,772.

The East Indian Railway Company takes a large quantity of iron from this Factory. The Oudh and Rohilkhund Railway C pany and other lines take castings. The castings consist of sleepers, water pipes, etc.

The condition of the Bengal Iron and Steel Company's busines now most satisfactory. A few years ago it was the general idea the works would have to be closed, but the present management completely changed that state of affairs.

Birbhum.—Iron ores occur in and about Mahammed Bazar elsewhere, and some twenty years ago Messrs. Burn & Co. establis iron works at the above-named place, but ultimately abandoned th as unprofitable. Iron ware is manufactured in parts of Birbhum local use.

Howrah.—There are four iron works in Howrah of which deta information is not at present available.

Midnapur.—There are block-iron ores in different parts Pargana Sildah. They are in heaps on the surface of the earth are used by the blacksmiths for preparing iron called *Genri* i

The iron stones are crushed into powder and layers of the powder with coal between the layers, are arranged in a circular Then fire is set to it. After they are well burnt they are taken and beaten with a hammer for some time until they are conve into pure iron. This is the rough mode of preparation in use h For want of a regular iron foundry, the manufacture of this c of iron is carried on on a very small scale, but the iron is

BENGAL.

superior quality. The estimated production is about 100 maunds, valued at ₹500.

24-Parganas.—Iron scales are manufactured at Arh-Debhoy in thana Baraset of the district of 24-Parganas and exported to Calcutta. They are strong but not so fine as the scales imported from England.

The manufacture of iron scales being of insignificant proportions, no detailed statistics are furnished. The ordinary price of a pair of scales ranges from six annas to one rupee.

RAJSHAHI DIVISION.

Pabna.—Spades, axes, sickles, plough-shares, etc., of the ordinary kind are prepared in this district by the blacksmiths and also at the local Technical School, where pen-knives, bolts, keys., etc., are made.

DACCA DIVISION.

Backerganj.—Woogirpur, a village in the Sadar Sub-Division, produces fine cutlery prepared from iron imported from Calcutta. A kind of saw turned out in that village and worth about ₹20 is largely exported to Dacca and elsewhere for cutting conch.

Dacca.—It is conjectured that in some past time there were extensive iron factories is Bhowal and that the black *kankars* are mere *debris* of such iron-works. The soil under the heaps of *kankar* is the same as that of the locality. Vegetables grow in abundance upon it, and jute and mustard in particular. The estimated production of black iron slag stone in Dacca is 555 tons, valued at about ₹300.

BHAGALPUR DIVISION.

Bhagalpur.—There are two kinds of iron ore, *viz.*, Sotia and Dhangá, produced in small quantities on the Khut Khutia hill in the south-west of the Katoria Thana in the Banka Sub-Division. The former is gathered by women and children from sand in the dry beds of hill streams in very small grains, while the latter is dug out of pits in large gravels by *Koles*. The ores have previously been worked, but the exact date of commencement is not known. The geological peculiarities of the soil where the ores occur are rocky and gravelly. There are 21 works in 14 villages in the south and north-west of the Katoria Thana and 3 persons are daily employed on an average in each work, and paid at the rate of 2 annas per diem for 6 months. The pits from which the Dhangá is dug out are worked by *Koles*. They are from 5 to 6 feet deep. The ores found are finely ground, the earth sticking to it being either washed away or blown off when it is dry. They are then refined in a large clay tub with a hole at the bottom. Charcoal fire is prepared and on the fire the ground ore is sprinkled from time to time. The fire is continually blown by means of bellows; when the fire is very strong, the iron part of the ore is

IRON. | **The Iron Industry as carried on**

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molten and flows down through the hole in the tub into a clay m The iron is thus collected in a lump in the form of bricks. bricks are taken to the market for sale. The present state industry is declining. There are no regular factories in the I Sub-Division. The crude iron is worked into manufactured ar by the ironsmiths at Jeypore, Katoria and Khesar. There wa import of the crude or manufactured produce, but a small qu (about 90 maunds, valued at ₹225) of the manufactured iron exported from Jeypore, Katoria, and Khesar to Karagola, Deoghu Dumka. Kodalis, ploughshares, kataris, etc., for the use of the classes are made of the iron locally produced.

Maldah.—Rough agricultural tools, such as ploughshares, sic etc., are made here by the ironsmiths (*kámárs*). These article never exported. The average wages of the *kámárs* are not m than four to six annas a day.

Monghyr.—Guns and pistols of local manufacture are expo every year to Calcutta and other places for sale.

CHOTA NAGPUR DIVISION.

Hazaribagh.—Iron ores, such as cooking utensils, agricult implements, etc., are manufactured in this district for local use.

Manbhum.—Sword sticks and other articles of iron ware turned out in the municipal town of Jhalda in Manbhum both for l sale and exportation. Guns of the native pattern used also t manufactured at Jhalda, but since January 1898 the issue of licen for the manufacture and sale of these firearms has been discontin under the Commissioner's order.

The Iron Industry in the Central Provinces.

INTRODUCTORY.

In his letter forwarding the returns, the Commissioner of Set ments and Agriculture remarked thus :—

Discrepancies in the price of ore, and in the proportion borne smelted iron to the ore continue to impair the value of the retu In paragraph 75 of the Review of Mineral Productions in India 1897, it is stated by the Reporter that however rich the ore, proportion borne to it by the finished metal can scarcely exceed 30 cent.

The amount of iron entered in the statement, is arrived at first obtaining from the smelters the amount of their out-put, th ascertaining the ratio of the crude ore to the smelted product, a finally calculating by means of that ratio the amount of ore from wh

the out-put must have been derived. If the out-put is wrong, or the ratio adopted is wrong, the information given in the statement is necessarily incorrect. The ratios reported in the various districts which produce iron is as follows :—

	Iron ore.		Smelted iron.
Saugor	7	:	1
Jabalpur	5	:	1
Mandla	3	:	1
Seoni	4	:	1
Narsinghpur	4	:	1
Chanda	$3\frac{1}{2}$	:	1
Bhandara	$3\frac{1}{2}$	:	1
Balaghat	3	:	1
Raipur	4	:	1
Sambalpur	13 (?)	:	1

The Deputy Commissioner of Sambalpur who gave a ratio of 7 : 1 last year and who now reports 114 furnaces to have been working as against 21 last year, and the rate per ton of iron ore to be R0-15-8 as against R3-12-10 last year, has been asked for an explanation. Meanwhile, this report which is already overdue cannot be delayed. The rate per ton works out in Mandla to R11-13-0 and is quite out of accord with the rates in other districts. But the truth is that the value of the crude ore can only be arrived at by adding cost of quarrying to the royalty payable. As the royalty is levied on the furnace and frequently (when the ore is smelted with charcoal taken from Government Forests) includes a charge for fuel, it is evident that the price figures shown in the returns are artificial and useless for all practical purposes. It would seem of more value to state the market price of the pig iron obtained.

As the returns stand, however, (and they are far more accurate than they used to be) the amount of ore extracted was 3,027 tons as against 2,387 tons in the previous year. But in spite of this extra production, it would appear that the industry is not in a flourishing condition owing to the competition of imported iron. A great deal has been done of recent years by the Forest Department by cheapening fuel and lowering royalties to set up the languishing industry, but until a market for the iron produced is created, success cannot be looked for. The quality of the iron in Jabalpur, and I may add in Chanda, is believed to be very good, but production will have to

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be on a larger scale so as to be cheaper than it is at present b any steady demand can be expected. At present the accounts show that the industry only yields a bare subsistence to those empl in it.

Deputy Commissioner.

Saugor.—There are 6 iron mines in the district, situated in ma Tigada, Hirapur and Baretha in the Banda tahsil. These mine not leased out to monopolists, but are open to all-comers. Any pe taking ore out of these mines and working it up, is charged a rate of 8 annas for each furnace used by him. Details of furn working are given below :—

Name of village.	Number of furnaces.	Annual duty. R	*a.*	*p.*
Hirapur	15	7	8	0
Baretha	8	4	0	0
Tigada	12	6	0	0

The total number of persons employed was 1,790, the t earnings R588 and the total wages paid R207.

Deputy Commissioner.

Mandla.—Number of furnaces working during the year was These are worked on annual licenses issued by Forest Departm for which R8 are charged per furnace. This includes royalty as w as the cost of fuel and charcoal used by the smelters. Royalty estimated at R4 per furnace. The quarrying cost is estimated at per furnace. Since the close of the year rates of license fees ha been reduced as follows :—

	R
For one furnace	8
„ two furnaces	12
„ three furnaces	15

Forest Divisional Officer.

The industry has declined during the year, the number of furnac worked being 27 against 33 in 1897. In nearly all cases the men w have abandoned their furnaces are now supporting themselves working as ordinary "lohars." It is anticipated that the reductio in the rates of license fees referred to above will bring about revival of the industry especially in the remote parts of the distri The people themselves state that their annual earnings are fro R25 to 30 per furnace.

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Jabalpur.—The real cause of the decline in the iron industry is due to the increased importation of English metal and the consequent fall in demand for the country product.

Forest Divisional Officer.

The following statement which has been compiled from records in the Municipal office shows that, while the quantity of English iron has increased, the Native product has steadily decreased.

Year.	English Iron imported.	Native Iron imported.
	Mds.	Mds.
1895-96	5,178	5,806
1896-97	6,468	4,998
1897-98	7,599	3,237
1898-99	7,476*	1,487*

Coupled with the above, the rates for English metal have decreased from R6 to R4 per maund for new iron, and R1-12-0 to R0-8-0 for scrap iron during the above period. The imported iron is obtained in bars and strips which makes it much easier to work up than the "tickolis." There is no doubt, however, that the metal of the district is of good quality, and that it only requires capital to work it to advantage. It is stated that the Public Works Department used at one time to have their implements made from the iron procurable in the district, but owing to the cheaper rate and better finish of articles purchased from English firms the Native iron was given up.

Deputy Commissioner.

Narsingpur.—During the year under reference there were 8 furnaces working as against 10 in the previous year, but the number of mines remained unchanged. The total number of persons who find employment in this industry and the amount of wages earned by them have somewhat decreased. The industry appears to be declining and the decline is attributed to the industry not being a sufficiently paying one.

Deputy Commissioner.

Bhandara.—During the year 1898, there were 12 furnaces in operation for smelting iron from iron ore. They worked during the 8 dry months of the year. Six persons were at work at each furnace; of whom 4 were males and 2 females. Thus, 48 men and 24 women were employed during the year for production of iron. The total output of smelted iron at 12 furnaces was 39,168 seers, each furnace giving about 3,264 seers in 8 months. This quantity was worth

* These figures are for 9 months only.

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R1,843 at the rate of one rupee for $2\frac{1}{2}$ pieces containing $21\frac{1}{2}$ Accordingly, the gross earnings of each furnace were R154. Th of wages paid to labourers employed was R1,536, each male lab being paid 2 pieces of iron worth about R0-12-9 and each femal ting one piece worth R0-6-4 per week. In addition to the amount a sum of R75 had to be paid to the zamindars for fuel and bamboos removed from the forest for use at the furn Thus the total expenditure on the business amounted to R1,6 R134-8-0 per each furnace, and the net earnings of the workers R232, or about R19-5-0 from each furnace.

Deputy Commissioner.

Raipur.—There are altogether 33 furnaces working in following villages in the Dondi-Lohara Zamindari in quarrying iron ore and smelting the same into iron :—

Name of village.	Number of furnaces.
1. Rithe Konda	6
2. Bhimdo	4
3. Dulli	2
4. Kopedera	5
5. Kurmudkota	4
6. Angara	2
7. Bitejhur	3
8. Puswara	7
TOTAL	33

The workers pay R11 per furnace as royalty to the zamindar use as much ore as they can throughout the year. Besides roy they have to spend nearly R400 per furnace per year in defraying cost of quarrying and charcoal used. Thus the total cost per furn per year is R411. Each furnace produces on an average 2,400 seer smelted iron, which is sold at the rate of 4 seers per rupee. The gross receipts amount to R600 and the net profit is nearly R It has been found that approximately 4 seers of iron ore produces seer of smelted iron. It thus appears that nearly 9,600 seers of ore are used per year per furnace.

In a letter No. 474 C., dated the 17th February 1899, to Conservator of Forests, Northern Circle, Central Provinces, Mr. H Bartlett, Forest Divisional Officer, Narsingpur, reported thus :—

Narsingpur.

The iron industry is only carried on in the Tendukhera Ra and appears to have steadily decreased. Formerly there were

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furnaces, in 1895 this number had decreased to 25, and in the present year there are only 7 reported. The number of persons engaged in working and supply of each furnace is 14 on the average, 5 being employed in digging and carrying the ore, 4 in attending to the furnace, and 5 are engaged in making and supplying the charcoal used in the furnace. Thus for the 7 furnaces, 98 people are engaged. The furnaces are extremely primitive, and the pig iron produced sells at the rate of 20 seers per rupee.

The pig iron is refined by heating and hammering and some 4 or 5 persons are engaged in this work. The iron ore is brought to the furnace in 2 maund loads, at the rate of 7 loads per rupee.

Kheri (steel?) sells at 10 seers per rupee—manufactured articles are seldom sold by weight.

From the purified iron are prepared—

Pans.	Karhai	sickle.	Hansia. Pans.
	Tawa	lower part of bakhar.	Phar.
Spoons.	Karchhe.	hooks	Kanta.
Axes.	Kulhari.		

The Kheri is used for edging tools.

In a letter No. C. 480, dated the 25th February 1899, to the Conservator of Forests, Northern Circle, Central Provinces, Mr. H. E. Bartlett, Forest Divisional Officer, further reported that :—

Narsingpur.

(*a*) The iron ore used is of two kinds, the first called *pakka dhan* is brownish yellow in colour, the second called *kachha dhan* is red purple. The iron cannot be extracted from the former unless mixed with some of the latter ore.

(*b*) The furnace used for smelting the ore is built of sun-dried brick and across the centre of an oblong pit dug in the ground. The pit is 4 feet by 10 by 3 feet deep and the block of masonry containing the furnace 4 feet × $2\frac{1}{2}$ feet × 4 feet high, the pit is thus divided into two. In one half are a pair of leather bellows of concertina form with two iron blast pipes leading to the furnace. On a seat behind the bellows sits a man who works them alternately with his hands and thus produces a steady blast.

In the block of masonry on the bellows side is a shaft about $1\frac{1}{2}$ feet square at the lower end, and 9 inches square at the upper end. Three faces of the shaft being the masonry and the third face consists of a

thin clay wall. This is the furnace. The foot of the sh stone and there is a small orifice on the one side for th nozzle, and on the other side where the masonry has been ho out on the level of the pit so as to reduce the thickness of th wall, a hole for the escape of slag. The top of the shaft open and through this the ore and fuel are fed.

Over the bellows is a screen of clay supported on wattlework The nozzle is of clay 6 inches long, and single.

(*c*) Crushed ore to the amount of $9\frac{1}{2}$ maunds consisting parts *kachha* and 1 part *pakka* are mixed with $9\frac{1}{2}$ maunds of cha and fed into the furnace and the blast kept going. Graduall slag trickles out into the second pit through the hole provided is removed. After about $2\frac{1}{2}$ hours, the smelting is complete mass of pig iron, weighing about $1\frac{1}{2}$ maunds is obtained.

(*d*) The furnace used for the preparation of kheri (steel ?) d somewhat from that used for iron, it is more strongly built so withstand greater and more prolonged heat and is entirely closed except for the chimney. The one seen by me was not sunk pit and was parabolic in section but having a vertical plain fac one side, *i.e.*, the side next the bellows. It was 5 feet high, 6 feet meter at base and the shaft tapered from $1\frac{1}{2}$ feet at base to 9 inc square at the upper end. Two nozzles are used made of clay 2 long and 4 inches diameter, rather cigar-shaped, $1\frac{1}{2}$ feet being inside furnace.

(*e*) The charge used is $9\frac{1}{2}$ maunds of ore consisting of 3 p *pakka* and 1 part *kachha* ore, mixed with an equal weight of charc The furnace being closed, the heat is more intense and the b through the two nozzles, is continued for 14 hours.

(*f*) The pig thus produced is not used in any local manufact and is not purified, but is sold in the bazar to villagers who t it with them to their village-smiths for edging their axes and other to

It is also exported to Chhindwara, Hoshangabad and Seoni, at the present time there is but little made. In appearance it is c talline, very bright and hard, and a piece hammered out for I find, on heating gives the usual-temper colours of steel from yel to blue but on fracture is more like cast iron in appearance.

(*g*) The only local iron industry going on at the present tim the making of " pans " for the under-side of *bakhars*. This is d in two stages and the forge is of the ordinary primitive form,

draught being supplied as in the smelting furnaces. Round the anvil in a semi-circular trench, stand the hammermen 4 in number with hammers weighing from 2½ to 4 seers, behind the anvil sits the head smith who turns and steadies the bloom on the anvil and directs the work. A mass of pig weighing about 10 to 12 seers is taken, heated and hammered, cut into two and each half shaped into a half *pans*. The weight of each half when finished is 3 seers. Thus the pig iron loses about ½ its weight in the process. During the operation the iron is heated seven times. In the second stage the two halves are welded together to form the pans, this is carried out in another shop where the same type of forge is used but there are three hammermen. The welding is done without any sand or other flux. A fourth hammerman working by himself finishes off the pans cold when it is ready for sharpening.

(*h*) There are 12 smelting furnaces at present at work in Tendukheda, only one being used for the preparation of kheri.

The wages given are as follows :—

Smelting furnace working 12 hours at night, 4 men at 3 annas per diem.

Forge, for shaping half pans from pig iron working 12 hours at night :—

	R	a.	p.
4 hammermen at Ro-3-3 . . .	0	13	0
1 blower	0	3	0
1 head smith	0	6	6
TOTAL	1	6	6

They turn out 22 half pans per diem.

Forge for welding and finishing.—Six men on the same wages as above : these work in the day time and turn out about 25 finished pans per diem. The charcoal used in the different works is purchased in Tendukhera Bazar at 8 annas per buffalo load, about 3 maunds.

Mr. R. S. Hole, Forest Divisional Officer, Jabalpur Division, letter No. G.2, dated Camp Burgi, 5th April 1899, reported to the Deputy Commissioner, Jabalpur, as follows :—

The number of furnaces which were working in the District last year, 1898, which obtained ore from the mines under the control of the Forest Department, or their fuel from Government

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Forests, is 25. These furnaces, however, were only working all in one month, *viz.*: February, during the remainder of the season, one or more had stopped working. The number of fur work during each month is as under :—

Year.	Month.	No. of furnaces.
1898	January	23
„	February	25
„	March	24
„	April	23
„	May	19
„	June	6
„	July	6
„	August	6
„	September	6
„	October	6
„	November	5
„	December	13

2. The estimated out-put of smelted iron is arrived follows :—

Each furnace when in work produces on an average 35 se *bloom* or rough smelted iron daily, and the following table sho each month the number of such blooms produced and thei weight :—

Month.	No. of blooms.	Weight in seers.
January	510	17,850
February	513	17,955
March	489	17,115
April	553	19,355
May	429	15,015
June	77	2,695
November	122	4,270
December	245	8,575
	2,938	102,830

This has been taken as equal to 94 tons roughly.

3. In order to produce one rough bloom of iron weigh seers, about 180 seers of ore are necessary, and therefore to p 2,938 such blooms, 2,938 × 180 = 528,840 seers, or 486 tons

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4. The royalty on ore is charged at the rate of R12 per f for the whole working season of 7 months or at the rate of R

per month. The total amount of royalty of R291 may seem very high when compared with the total quantity of ore extracted, but it must be remembered that the smelters extracted far less ore than they were entitled to do. Thus, instead of 486 tons which was actually removed, the smelters were entitled to remove 855 tons. This is caused by many of the furnaces only working for very short periods.

5. The cost of quarrying and bringing the ore to the furnaces is about R0-2-4 a day on an average, although occasionally men are engaged to bring the ore at the rate of R6 to 7 per month.

6. With regard to the number of persons employed the following details are given :—

Each furnace, when in work, employs on an average the following number of persons at the appended daily wage :—

Particulars of work.	No. of persons.	Per head wages.			Total wages.		
		R	*a.*	*p.*	*R*	*a.*	*p.*
Extracting and carrying ore to furnaces	2	0	1	2	0	2	4
For managing the furnace	1	0	3	10	0	3	10
	1	0	2	0	0	2	0
For cutting wood and making charcoal	8	0	1	3	0	10	0
	12	0	8	3	1	2	2

so that during 1898 the following number of persons at the rate of wages indicated were employed :—

Month.	Total number of persons.	Total wages earned.		
		R	*a.*	*p.*
January	6,120	579	1	0
February	6,156	582	7	6
March	5,868	555	3	6
April	6,636	627	14	2
May	5,128	487	1	6
June	924	87	6	10
November	1,464	138	8	4
December	2,940	278	2	10
	35,236	3,335	13	8

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This does not of course mean that 35,236 different perso employed, as many persons employed one month, were also er during the next month, and so on. Probably not more tha different people received employment, including women and c who are employed in making charcoal and extracting and b the ore to the furnaces, and these also only for short periods.

7. With regard to the extent of the industry and its fi aspect the following figures may be considered. The total during the year has been put down in paragraph 2 above at 2,938 or blooms. These sell on an average at R1-8-0 each, so th total outturn is R4,407. The expenditure consists of the dues for ore (at the rate of R12 per furnace for 7 month charcoal (at the rate of R38 per furnace for 7 months), an cost of labour mentioned in paragraph 5 above. Only 14 furnace the forest dues for wood, the remaining 11 getting their ch from malguzari lands, probably free or at a nominal rate. Th of these took out licenses for the whole season, thus paying R3 and the remaining one for 2 months only.

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The total expenditure, therefore, is as follows :—

	R	a.	p.
Labour	3,335	13	8
Royalty on ore 24 furnaces for 7 months at R12 each 1 ditto for 2 ditto R3-6-10 Royalty on wood.	291	6	10
13 furnaces for 7 months at R38 1 ditto for 2 ditto at R10-13-8	504	13	8
	4,132	2	2

Thus only a profit of R275 is realized on an outlay of R or, in other words, about 6½ per cent.

8. These figures differ slightly from those furnished with year's return, but in the latter the industries of iron smelting and ing were considered together as if they went on hand in hand this is not the case and it rarely happens that all the iron smelt any one year is refined during that year. In reality the two indus are distinct and the class of people engaged in the two case

different. The smelters or *bhattiwalas* are poor ignorant indivi-
s, by no means always Lohars, by caste, whereas, the refiners
killed smiths are invariably Lohars. The latter purchase the
mery iron from the smelters when they want it and at once make
into marketable articles, and occasionally capitalists, often large
owners, buy it up and keep it in stock until they find a market
t. The estimated out-put of bloomery iron for 1897 was put down
30 tons, whereas this year's out-put is only 94 tons. This is ac-
ted for by the fact that a considerable quantity of the iron pro-
d in 1897 could not be disposed of that year and there was
equently a smaller demand and less iron produced during 1898.
he industry is at present carried on there is a very limited, but
ne same time fairly constant demand for the iron produced. If
e iron is produced during any one year than is sufficient to satisfy
demand, the almost invariable result is that less iron will be
uced the following year.

. The principal mines in the district have been in the charge
e Forest Department during the year, this step having first been
n in 1894 with the object of resuscitating and improving the
bund industry. The steps which had been previously taken
to lower the existing rates for ore and wood and to give money
nces to the smelters in times of distress to enable them to conti-
working. This resulted in more iron being produced than could
ld and in drugging the market. It has now been recognised
it is quite impossible for the native charcoal-iron to compete
the ordinary kinds of iron and steel made from mineral coal
h are imported in steadily increasing quantities, sold at extremely
ates, and, moreover, put on the market in a form most con-
nt for the manufacture. The object must be therefore to create
nand for the native iron similar to that which at present exists in
pe for Swedish charcoal pig, whereas English pig made with
ral coal only fetches from 35 to 40 shillings a ton, Swedish char-
iron fetches from 80 to 100 shillings. It should also be borne
nd that the Native charcoal-iron is "perfectly tough and mal-
e and superior to any English iron or even the best Swedish."
ng the current year, therefore, every effort has been made to attract
tion to the metal and to open up an extensive market for it, and
prominent Railway authorities are now giving the matter
attention. In order also to get an accurate idea of the details

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in which the present Native method is capable of improvem experimental furnace was worked during the rains in the fores pound, and reliable data obtained regarding the exact quantity coal and ore required to produce a definite amount of bloome Arrangements have also been made in the working-plans Government Forests to provide a permanent supply of charco number of small furnaces.

Mr. E. E. Fernandez, Officiating Conservator of Forests, N Circle, Central Provinces, with his letter No. 4206, dated Ja the 15th July 1899, to the Second Secretary to the Chief C sioner, Central Provinces, submitted the following report :—

JABALPUR.

The custom of the iron-smelters of the Jabalpur District is no flux with the ore, and to confine their operations to the months from November to May, both months inclusive, belief that owing to the dampness of the soil during the months a sufficiently high temperature cannot be maintained furnace, the hearth of which is about 2 feet below the level ground. The obvious thing for us to do was therefore (i) to effect of a flux, and (ii) to carry on smelting operations durin rainy season. Accordingly a furnace of the usual pattern was b my office compound and worked during the rains of 1898.

First, as regards the results obtained with the use of a flux. outset I must premise that the Indian smelter does not reduce his to a molten condition : the slag is run out liquid, but the iron behind on the hearth as a pasty spongy mass, and is removed from in that condition while it is still at a whiteheat. Hence the object with which a flux could be employed was to assist in the removal of the slag. The nature of the furnace was, however, su to prevent a fair trial being given to the use of the flux. The chi was, as usual, built up with burnt bricks laid in mud mortar an sides were, before each smelting, covered over with a fresh plasteri clay in order to render them smooth. The immediate result use of the flux was to cause this plastering to melt or break away fall on to the half-molten mass on the hearth below, thus seri interfering with the smelting. Also some of the iron got sm and ran out mixed with the slag. Neither of these two mishaps w have occurred had the chimney been built with fire-bricks an blast been properly regulated. Taking actualities only the re

obtained with and without the use of a flux are compared here below :—

	With flux.	Without flux.
Number of blasts	21	29
Quantity of ore smelted	102 mds.	134½ mds.
„ „ used per blast	4·86 „	4·64 „
„ lime used as flux	100 lbs.	
Outturn of bloomery or pig iron	31 mds. 39 srs.	47 mds. 30 srs.
Percentage of pig to ore used	31·4	35·5
Average yield of pig per blast	1·52 mds.	1·65 mds.
Percentage of refined iron to ore used	17·6	18·5
Percentage of refined iron to pig used	55·9	52·2

A few comments on the foregoing figures may be of use :—

(*a*) As the ore used (Partabpur) contains, according to laboratory analysis, 65 per cent. of iron, the yield in neither case was absolutely satisfactory.

(*b*) The yield of iron was practically the same in both cases.

(*c*) The average yield of pig per blast was 5 seers larger without the use of a flux, but then it must be remembered that the melting of the plastering of the chimney and the absence of proper regulation of the blast must be held responsible for a very appreciable loss of iron due to its melting and running out with the slag. When the flux was used the blast should have been slightly diminished and increased only after all the slag had been drawn and the holes made for its issue plugged up. In that case the yield of pig would, I am certain, not have been different and that of refined iron would have been appreciably in favour of the flux system. With the chimney and hearth constructed with fire-bricks the advantage of this system over the other would be incontestable.

(*d*) In spite of the soil round the lower third of the chimney being sodden during the greater part of the time, the yield per blast was good. During a few days the work had to be stopped in consequence of the pit where the blowers sit being flooded and water oozing out everywhere from its sides. Thus the possibility of carrying on smelting operations

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all the year round has been proved in the most in able manner.

(*e*) The blowers used were the usual concertina-shaped skin bellows worked by a relay of two men. I blowers are employed which require less exertion to relay consisting of three men could work two fu thus saving 25 per cent. on labour. If a set of furnace set up below a large tank or wherever water-pow available, manual labour would be reduced to a min A small wooden water-wheel, like those used at Ol metallic paint factory at Murwara and developing ½ horse power, would not cost more than R15 — 20 a cost would be recouped in two months by the re saving of labour and greater effectiveness combined.

The East Indian Railway Company is now conducting e ments to test the feasibility of utilising our bloomery iron i foundries at Jamalpur. Should these experiments prove succe the Company will require several thousand tons of blooms, a ci stance that will at one stroke not only resuscitate our loca industry, but raise it to a level it has never attained to before. exertion on our part will then be required to secure such a summation. Should this hope not be realised, we shall ha continue experimenting until by increasing the outturn and red the cost of production we enable the locally produced iron to co with the imported article ; but until rolling machinery is introd this latter will always command an undue advantage over the production.

G. I. C. P. O.—No. 3 R. & A.—3-10-1900.—2,230.—B. N. D.

etable Product Series, No. 61.)
(Food Substances.)

THE AGRICULTURAL LEDGER.

1900—No. 15.

MANIHOT UTILISSIMA.

(CASSAVA.)

[*Dictionary of Economic Products, Vol. V.*, M. 216-30.]

TAPIOCA PLANT CONSIDERED AS AN ALTERNATIVE FOOD-STUFF IN SEASONS OF SCARCITY AND FAMINE.

Correspondence between MR. ROBERT THOMSON *and Her Majesty's Secretary of State for India and the Government of India.*

ıe reader's attention is invited to the correspondence given on 11-13 of *The Agricultural Ledger*, No. 4 of 1897. In that he position of **Manihot** (Tapioca plant) in India is briefly de-d (pp. 1-2). Very little has since transpired that would tend to the writer's personal views therein expressed, but the following pondence will doubtless be found of interest.

Secretary, Revenue and Statistics Department, India Office, to the etary to the Government of India, Department of Revenue and Agri-ıre, No. 237 R. & S., dated the 26th January 1900.

ı directed to forward, with reference to the despatch to the Government of India, No. 64 of 22nd April 1897, a copy of correspondence with **Mr. Robert on** relative to the utilization in India of the Cassava plant.

Mr. Thomson, December 28th, 1899.
Do. January 18th, 1900.
Do. ,, 20th, 1900.

Dated Grass Mount, Forest Hill, S. E., December 28th, 1899.
From—Robert Thomson, Esq.,
To—The Under-Secretary of State for India.

ɔntinuation of my letter, dated the 25th January 1897, and with ce to your letter in reply, dated the 15th April 1897, R. & S. 892, the honour to submit the following observations.

MANIHOT utilissima.

The Tapioca Plant considered as an Alternative Food-stuff

MR. ROBERT THOMSON ON CASSAVA.

Not having received any further communication on the subj has occurred to me that my suggestion set forth in my letter ha been sufficiently understood.

In the second paragraph of your letter it is stated that both the and sweet Cassava plants have been known in India from the ea conquests of the Portuguese, and that the former (**Manihot ut sima**) is already naturalised in Assam, and used by the natives article of food.

Now this bitter Cassava thus stated to be "used by the nativ an article of food," contains "hydrocyanic acid," and "being t fore highly poisonous the root cannot be eaten in a fresh condition

Varieties of Cassava met with in Columbia.

What I specially called attention to in my aforementioned letter that apart from the bitter and sweet Cassava varieties known i East and West Indies, there are numerous very important vari of Cassava under cultivation in Columbia, varieties which are e sively used in lieu of, and generally in preference to, potatoes, co in the same way as the latter, not made into cakes, etc., from farina. These Columbian varieties are unknown in the East and West Indies.

I at the same time laid particular stress upon the adaptabili these varieties to flourish in semi-arid regions, arid conditions u which no other important food plant could be productive.

Extract from Encyclopædia Britannica.

With regard to the rainfall requisite for the cultivation of I respectfully beg leave to quote from the *Encyclopædia Britan* article "India."

"It has been estimated that in the absence of irrigation, the crop requires an annual rainfall of at least 36 inches, and an In province requires an average fall of not less than 50 to 60 inches in c to grow rice as a staple crop." In contrast with this I have care ascertained from extensive practical experience that many of Columbian varieties of Cassava flourish with a total annual rai of from 14 to 16 inches, and in addition to this the plant thrives ad ably when droughts extend over six months at a time. Hence people of India would have recourse to an article of food which is subservient to extreme conditions of humidity, as is the case with but an article of food which luxuriates under conditions of extr drought. Furthermore, many of the varieties of this plant are equ amenable, under certain conditions of soil, to excessive rainfall, from 150 to 200 inches annually."

in Seasons of Scarcity and Famine.

MANIHOT utilissima.

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I also quote from the same *Encyclopædia Britannica* article on "India," "But in all these cases, when the rainfall has failed over a series of years, the artificial supply must likewise fail after no long interval, so that irrigation becomes a snare rather than a benefit. Water-works on a scale adequate to guarantee the whole of India from drought are not only above the possibilities of finance; they are also beyond the reach of engineering skill."

Other grounds for growing Cassava of Columbia in India.

My recommendation of the cultivation of the special varieties of Columbian Cassava in India is, I venture to submit, further emphasised by the following quotation from *The Times* of the 18th instant, *viz.*, a communication published in that paper from the Secretary of State for India addressed to the Lord Mayor of London on the subject of the famine in India. "The Government of India reported some weeks ago that probably 350,000 square miles and a population of 30,000,000 would be affected by famine." This means an area seven times greater than that of England affected by famine at present. Also according to the most recent information from Calcutta "about 2,500,000 persons are receiving relief in India owing to the scarcity."

The disasters attendant upon widespread famine throughout vast areas of India, are as absolutely dependent upon heavy rainfall for the production of the great staple food. Rice and millets would be most materially mitigated by the introduction of the cultivation of the food plant I recommend. In other words, Cassava is pre-eminently a drought resisting culture requiring for the perfect development of the crop only from 14 to 16 inches of rain per annum as compared with 50 to 60 inches for rice. "All the great famines in India of which we have record have been caused by drought, and usually by drought repeated over a series of years."

Cassava a drought-resisting crop.

Further extract from Encyclopædia Britannica.

Encyclopædia Britannica.—The same work says: "Warren Hastings, the Governor General, advocated the construction of enormous granaries, to be opened only in times of necessity." Again same work, "Warned by the failure of the rains, and watched and stimulated by the excited sympathy of the public at home, the Government carried out in time a comprehensive scheme of relief. By the expenditure of 6½ millions sterling, and the importation of one million tons of rice, all risks even of the loss of life was prevented."

There can be no doubt that the wide distribution of Cassava cultivation, a subsidiary crop to that of rice, etc., would have the effect

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of warding off famine in India. And this too with a moderate expenditure of money.

With a view to the establishment of Cassava cultivation the G ment could set the example by offering substantial encourag to the natives. The Government could also establish large plant independently.

Cultivation.

One man can cultivate 6 acres of this plant the yield from amounts to 60 tons of tubers per annum at a cost of ten sh per ton (less than half the cost of coals in London). Thus 1 of a precious article of food at a cost of one penny. Accor one man cultivates sufficient to support one hundred persons year.

Estimated yield.

One hundred square miles, grown on scattered plots, would duce food for 1,000,000 persons. In Ireland the area under p cultivation in 1846 was 1,933 square miles.

In the course of a year the natives would progressively themselves to the use of this article of food—a food which is pref to Rice by vast numbers of people in South America.

Proposed Uses for Cassava Tubers.

During plentiful Rice harvests, until the Cassava tubers are monly used and appreciated, cattle, etc., could be maintaine superabundant Cassava crops. And vast quantities of starch and f could be produced from the superabundant crops. In this co tion it may be mentioned that vast quantities of Rice import Europe have been used for starch-making.

The different varieties of Cassava could be imported to with the utmost facility, and millions could be propagated and for distribution in about a year's time.

No. R. & S. 3641, dated, India Office, 18th January 1900.
From—The Under-Secretary of State for India,
To—R. Thomson, Esq., *Grass Mount, Forest Hill, S. E.*

Species of Cassava suitable for India.

I am directed by the Secretary of State for India to acknowl the receipt of your letter of 28th December 1899, offering fu remarks on the suitability of the Columbian species of the Ca plant for cultivation and use in India.

In reply I am to enquire what species of Cassava you w specially recommend for acclimatization in India.

in Seasons of Scarcity and Famine.

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MR. ROBERT THOMSON ON CASSAVA.

Dated Grass Mount, Forest Hill, S. E., 20th January 1900.
From—R. Thomson, Esq.,
To—The Under-Secretary of State for India.

I have the honour to acknowledge the receipt of your letter of e 18th instant, R. & S. 3641, enquiring as to what species of Cassava would specially recommend for acclimatization in India.

Whether sweet and bitter Cassavas are identical.

The bitter and sweet Cassava are regarded by some authorities two distinct species. I consider them both to be merely varieties the same species, namely, **Manihot utilissima.** The numerous *rieties* in Columbia are distinguished by local vernacular names, ch as the rejona, criolla, moradita, blandita. Three years ago I id a list of some twenty varieties grown in two provinces of Colum-a, but I am sorry I am now unable to find the list. Very frequently e names by which the varieties are known in one province are quite fferent from the names given to the same varieties in other provinces.

I would respectfully venture to suggest that all the varieties ould be secured for India. At the same time special attention ould be devoted to the best varieties. The advantage of securing considerable number of varieties is, as mentioned in my letter of nuary 25th, 1897, that some grow in rich soil and some in exhausted impoverished soil. And further, that some grow on the hot plains id some at high elevations up to 6,000 feet above sea-level.

No. R. & S. 994, dated India Office, 3rd May 1900.
From—The Secretary, Revenue and Statistics Department,
To—The Secretary to the Government of India, Department of Revenue and Agriculture.

With reference to your letter of 13th March 1900 No. 363—27-3, I am directed to forward for information, copy of papers noted in the margin* on the ubject of utilisation of the Cassava plant in India.

* Letter dated 11th April 900, from Mr. R. Thomson.

Dated Grass Mount, Forest Hill, S. E., 11th April 1900.
From—R. Thomson, Esq.
To—The Under-Secretary of State for India.

I have the honour to acknowledge the receipt of your letter, dated ne 5th April 1900, R. & S. 829, enclosing copy of a note by the eporter on Economic Products to the Government of India on the uestion of utilising the Cassava plant as an article of food in India.

MANIHOT utilissima.

The Tapioca Plant considered as an Alternative Food-stuff

MR. ROBERT THOMSON ON CASSAVA.

In reply I respectfully beg leave to submit the followin marks :—

Dr. Watt's comments are not confined to Cassava, but em species belonging to other genera, yams, etc.

In paragraph 2 Dr. Watt says, "In a year or so more of enquiry I trust to be in a position to afford the Government of more trustworthy assistance in the direction indicated by Mr. R Thomson (in his various highly useful communications on Maniocs and Cassavas of Columbia, etc.), *viz.*, by being ab definitely say where supplies of suitable acclimatised or indige tubers can be at once procured for special cultivation in fa stricken areas. I have very little faith in the value of acclimatis in abstract, in the improvement of resources of a country. I dou 1 per cent. of the experiments hitherto performed in India of nature have proved of practical value. The process is a slow expensive one. The development of the existing resources by s tion is infinitely more satisfactory. It is with this object in view I am endeavouring to procure authentic information of the exte the food supplies of India of the nature mentioned."

It appears from these observations that Dr. Watt is not favour impressed as to the desirability of introducing new varieties or r of Cassava from other parts of the world. In India attention is now being directed to Cassava tubers as an article of food, Cas being there chiefly known as a source of tapioca, but the Colomb varieties, some twenty, to which I have made reference in my let have been from time immemorial cultivated in that country and are the result of slow and gradual selection.

With all deference to Dr. Watt I beg to say that my experi in tropical planting differs from his relative to acclimatisation. I h myself introduced to Jamaica numerous varieties of plants from m parts of the world, including many varieties from India, with most satisfactory results. An interesting illustration may be given. In 1865 I obtained **Cinchona officinalis** seed from Ce through Sir Joseph Hooker. After some ten years' cultivation species, including several varieties, was not only acclimatised, became naturalised. In the report of the Director of the Jam Botanical Department, *vide* "Bulletin" of the Department, Decem 1897, it is stated "seed of **Cinchona officinalis** is now sent e year by request of the Government of India to the Cinchona pla

ions on the Nilgiri, as it has been stated that the bark of trees grown rom seeds obtained there has deteriorated in quality."

As is well known Directors of Colonial Botanic Gardens highly prize valuable new varieties of plants obtainable from foreign sources for general cultivation for nearly all cultivated plants have been introduced. And Botanic gardens are sometimes surpassed by practical tropical planters, such has been the case, for instance, by the energetic planters of Ceylon. They do not hesitate to introduce important varieties.

In paragraph 3 **Dr. Watt** says, " Since the date of my former note on the bitter Cassava of Assam (1st March 1897), I have recently discovered that one of the forms of the sweet Cassavas is a regular article of food in Pondicherry, Cuddalore and Tanjore, its cultivation practically extending thence to Tinnevelly and Travancore." As stated in my previous letters the diverse conditions under which this plant grows in Colombia are extremely marked. Many varieties grow equally well on the hottest and most arid plains, and under conditions of excessive rainfall. And many varieties flourish at all elevations from the hot plains (a few feet above the sea) up to great altitudes, namely 6,000 feet above sea-level. The cultivation of this favourite article of food has been gradually drawn to the mountains, that is, the cold or temperate regions, by the more advanced civilization of the people dwelling at a great elevation on the Andes. There can be no doubt that the extremely varied climatic and other conditions to which Cassava cultivation has thus been subjected have had the effect of evolving the distinct new varieties or races now so generally cultivated in that country. These varieties have emanated not from seedlings, but from constitutional variations, they are exclusively propagated by cuttings, and it is well known that constitutional variations frequently arise where plants are largely exposed to extreme vicissitudes of climate and diversity of soils.

But **Dr. Watt**, as already quoted, says with regard to Cassava in India " The development of the existing resources by selection is infinitely more satisfactory." To inaugurate experiments of this kind as suggested by **Dr. Watt** with a view to raise new varieties or races would bearing in mind the paucity of varietal forms to work upon and the extremely restricted areas on which Cassava is found growing in India, under the most favourable circumstances involve very considerable loss of time, a long period of years, whereas a score

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of valuable new varieties are immediately obtainable from Colombi To show that raising new varieties is recognised as a slow proce Dr. Watt says that in a year or so he hopes to be in a position definitely say where (in India) supplies of suitable acclimatised indigenous tubers can be procured for special cultivation in famin stricken areas. But there is only one variety indicated by Dr. Wa grown in India, the tubers of which are used for food.

In view of the wide dissemination of the cultivation of numerou varieties of Cassava as well as in view of its remarkable constitutiona flexibility, there is every reason to believe that the said Colombia cultivated varieties will readily accommodate themselves to a wide are of India.

In this connection it is important to note that variety of Cassava the bitter Cassava, is already naturalised in India. It is impossible t adduce a stronger proof of the adaptability of the cultivation in general in India.

[If the roots came to us they would be most interesting, but it is probable that a few years at most would suffice to reduce all the various forms to which Mr. Thomson alludes to one or two, and that these would not differ materially from the acclimatised forms already met with in India.—Ed.]

M. 206-30.

(96)

G. I. C. P. O.—No. 2449 R. & A.—30-10-1900.—2230.—W. B. G.

THE AGRICULTURAL LEDGER.

1900—No. 16.

ODINA WODIER.

(GUM.)

[*Dictionary of Economic Products, Vol. V.*, O. 38-49.]

JINGAN GUM.

A Report by PROFESSOR WYNDHAM R. DUNSTAN, F.R.S., *Director of the Scientific and Technical Department of the Imperial Institute, on the chemical properties and commercial value of the Jingan Gum. To this has been added an abstract of reports on the tree that yields that gum, as furnished by Forest Officers. The present paper may thus be described as a revision of the Dictionary article on* **Odina Wodier.**

By his letter No. 286, dated 12th June 1895, **Mr. J. S. Gamble** submitted four gums, to the Reporter on Economic Products, for examination and report. These were forwarded to the Imperial Institute, and judging from **Professor Dunstan's** useful report on page 8, to which special attention is drawn, it would appear that of the four gums indicated, that of **Odina Wodier** or *Jingan*, is the most promising as an article of commerce.

The recent information to hand from Forest Officers regarding that tree may be said to confirm and, in some cases, amplify the particulars already known so that a review of the entire literature of **Odina Wodier** is likely to be found of interest to the public.

Odina Wodier, *Roxb.; Fl. Br. Ind., II., 29; Wight, Ic., t. 60; Ind. Kew., III., 328;* ANACARDIACEÆ.

Vern.—*Jingan, kiamil, kaimil, kimúl, kamlái, kasmala, ginyan, jhingan, mowen, mohin, moyen,* HIND.; *Jiol, bohar, jiyal,*

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lohar, bhadi, jír, jial, jival, ghadi, BENG.; *Dowka, dhoka,* KOL.; *Doka,* SANTAL; *Mooi, saripathri mooi, indrámai,* URIYA; *Hneingpyoing,* MAGH.; *Bara, dabdabbi, halloray,* NEPAL; *Kekeda,* KURKU; *Kaikra, gumpri, gharri,* GOND; *Jhingan, jingan, jibán, sindan, karalhí,* N.-W. P.; *Kiámil, kambal, batrín, kimlú, kemball, dhauntika, dila, kemal, koamla, sulambra, pichka, lidra, kamlai, kahmal, jingan,* PB.; *Gob,* RAJ.; *Simati, moya,* SIND.; *Gunja, monni, mageer, moyeen,* C. P.; *Shimti, ginyan, moya, kimul, moina, moi, simati, moja, shembat, molarda, gajel,* BOMB.; *Moi, moja, moye, shimat, munídi, shimti,* MAR.; *Wodier, wude, odiyamaram, odiamaram, otiyam, othiamaram, aunay-cauray,* TAM.; *Gumpini, gumpini banku,* the gum, *gumpani, gumpna, dumpini, dumpri, dumper, dampara, odai-manu, gumpena chettu,* TEL.; *Shimti, púnil, gojal, udi, suggipatte, shimli,* KAN.; *Nabé, nabési,* the gum, *knabe, knanbai, nabhai, nabhay, nabé-bin, knabé,* BURM.; *Jingini,* SANS.

References.—*Roxb., Fl. Ind., Ed. C.B.C., 336; Voigt. Hort. Sub. Cal., 275; Brandis, For. Fl., 123; Kurz, For. Fl. Burm., I., 321; Gamble, Man. Timb., 110; Dalz. and Gibs., Bomb. Fl., 51; Stewart, Pb. Pl., 46; La Maout and Decaisne, 363; Mason, Burma and Its People, 540, 774; Elliot, Fl. Andhr., 45, 65; Pharm. Ind., 60; Ainslie, Mat. Med. Ind., 486; O'Shanghnessy Beng. Dispens., 22; U. C. Dutt, Mat. Med. Hind., 301; Dymock, Mat. Med. W. Ind., 2nd Ed., 202; S. Arjun, Bomb. Drugs, 36, 207; Baden-Powell, Pb. Prod., 396, 397; Atkinson, Him. Dist., 308, 744; Econ. Prod., N.-W. P., Pt. I., 5; Lisboa, U. Pl. Bomb., 54, 242, 250, 278; Watson, Rep., 4, 22, 53, 55; Balfour, Cyclop., III., 8; Kew Off. Guide to Bot. Gardens and Arboretum, 37; Home Dept. Cor., 239; Burm. Gaz. I., 134, 137; Jour. Agri.-Hort. Soc., 1875, V., 75; For. Ad. Rept., Chutia Nagpur, 1885, 29; Gazetteers:—Mysore and Coorg, I., 52, 59; III., 28; Bombay, VIII., 11; XIII., 26; XV., 73; N.-W. P., I., 80; IV., lxx; Panjáb:—Rawalpindi, 15; Hoshiárpur, 11; Gurdáspur, 53; Shákpur, 69; Settlemt. Repts., Seonee, 10; Bhandára, 19; Nimar, 306; Betul, 127; Chhindwárá, 107; Manuals of Administration, Trichinopoly, 79; Madras, I., 362.*

Habitat.—A large deciduous tree, 40 to 50 feet in height, met with throughout the hotter parts of India from the Indus eastwards. It ascends in the South Himálayan tract to an altitude of 4,000 feet; is

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found also in Assam, Madras (chiefly in a cultivated state), and in Burma, the Andaman Islands, and Ceylon.

The following recently received particulars regarding the distribution of the tree may be here exhibited :—

North-West Provinces.—The tree is met with in the School Forest Circle.

Panjab.—Found abundantly in the Kangra Division. Wild and never cultivated it is principally associated with other miscellaneous trees in the scrub forests in which it forms one of the most conspicuous objects. It also occurs in the lower lying *chil* forests and the mixed forests on the main range up to about 3,000 feet. The tree grows in both dry and moist soils, but reaches its greatest size in valleys with a moist, deep soil—the wood in these situations is said, however, to be inferior. At the age of 30-40 years, when it is fit to be cut, the tree attains a height of 30-40 feet with girth 4-5 feet. It is leafless from November to February. Seasons of flowering and fruiting February-March and May-June. A report from the Forest Officer, Umballa District, states :—the Kalisar Reserve is the only forest in the Simla Division where the tree is found. It occurs scattered and not in any abundance. No particular care is taken to propagate the tree. It grows on the hot southerly slopes of the low hills, seldom reaching a height of more than 40-50 feet, or a girth of over 5-6 feet. The flowers appear in March-April when the tree is leafless, and the fruit ripens in June.

Madras.—Comparatively rare in the Ganjam District where it occurs wild on the lower slopes of the smaller hills and occasionally on the plains. Matures at the age of 50-60 years, attaining a height of 50 feet with girth 7 feet. Flowers in March-April, and fruits in June. Fairly common in the Bhadrachallam taluq, Godavari District, where it occurs in a wild state, both on the plains and at elevations up to (?)2,000 feet. It is estimated that the tree matures in about 30 years. Seasons of flowering and fruiting, February and March. In the Palamedu Range, Madura District, the tree occurs both wild and cultivated, though not abundantly. Sometimes propagated by means of cuttings. It thrives well in moist localities, attains a height of 40 feet with a girth of 6 to 8 feet, and is fit to cut at the age of 25 years. It flowers in April and bears seed in May. Not found in abundance in the Nellore District ; is chiefly confined to the Veligondas and Zerragondas hills. Also occurs to some extent in Sreeharikota and

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Udayagiri. Ordinarily the tree luxuriates (in Sreeharikota) by the sides of ponds and lakes and in the vicinity of human habitations. It is reported not to thrive in the forests far from dwellings. No special care is taken to propagate it. Fit to cut at 20 years, the tree attains a height of 30 to 40 feet with a girth up to about 6 feet. Seasons of flowering and fruiting, March and April-May respectively. The District Forest Officer, North Arcot, reports that the tree grows wild in the north of the district, but not in large numbers. It flourishes at elevations of 1,200-2,500 feet, attaining a height of about 25 feet with girth of 4-6 feet. In South Coimbatore the tree is here and there met with in the Udamalpet and Matupalayam Forest Ranges. It is also planted as an avenue tree on the Pokachi-Udamalpet Road, being usually raised from cuttings. In other places no special care is taken to propagate it. As a roadside tree it is not a success since it becomes quite leafless in the hot season. It grows wild in both dry and moist regions, reaching a height of 20-30 feet, with a girth sometimes as much as 8 feet. The tree flowers and fruits between May and July, and becomes fit for felling at the age of 20-25 years. It is reported to occur in the Tinnevelly District. From a report by the District Forest Officer, Trichinopoly, it is learned that the tree is found scattered in the plain and cultivated parts of the district. It does not grow wild but is generally propagated by cuttings. It flourishes in fertile and cultivated localities. The height to which it attains is from 50 to 70 feet, with a girth of from 5 to 12 feet. The tree is reported to be fit for cutting down at the age of 15 years. It flowers in May and fruits in June-July.

Burma.—Common throughout the Pegu Division where it grows wild and prefers low-lying situations. Average height 50-60 feet, but trees of 100 feet height and 9 feet 9 inches girth have been recorded. Usually the tree is not felled until it has reached a girth of 3-4 feet. The flowers appear in January and February; the fruits ripen in May and June. Fairly abundant in the Thayetmyo Division, growing wild in moist situations. Seasons of flowering and fruiting, December and January. Occurs plentifully all through the northern part of the Henzada-Thôngwa Division. The tree grows wild throughout the Henzada District. It flourishes in forest, at the foot of the hills, attaining a height of 30-40 feet with girth of 6 feet. Considered mature at the age of 35 years. The tree flowers in March and fruits

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April-May. Met with in the Lower Chindwin Division, but not to any considerable extent. Occurs wild on rather low ground. Has been known to grow to a height of 50-60 feet with girth 12 feet, but the average height is 35-40 feet and girth 5-6 feet. Regarded as mature at age of 15-20 years when a girth of 4-5 feet is attained. Seldom used. Seasons of flowering and fruiting end of May and July. From the Yaw Division it is learned that the tree is common in all the moister forests of the Division. Not cultivated, but grows wild; luxuriates on rather dry slopes in moderately moist forest. Attains a height of 70-80 feet or more and a girth of 4 feet 6 inches. It reaches an exploitable size at a very early age. The tree flowers in the hot weather and fruits about the end of May and June. Wild and very common in the Minbu Division. On good soil and situation attains a girth of 10 feet or more. From the Magwé Division it is reported to be fairly abundant in the forests outside the Reserve. Very scarce inside the Reserve, it grows wild in the level country outside, reaching a height of 40-70 feet with girth 3-6 feet. The tree is considered fit for felling at the age of about 20 years. The flowers and fruits are said to appear about April. Found almost everywhere in the dry mixed forests of the Mandalay Division up to about 3,000 feet elevation; the tree is, however, not plentiful. It occurs wild, prefers open jungle and appears to thrive best on stony soil. It attains a height of about 45 feet with a girth of over 6 feet. The tree flowers in February-March, but the seed does not ripen until 7 or 8 months later. Reported to be plentiful in the forests of the Pyinmana Sub-Division, Yamethin District, where it is associated with **Dipterocarpus tuberculatus, Shorea robusta, Pentacme Siamensis** and others. Grows wild mostly in "Indaing" forests attaining a height of 40-50 feet and girth of 6 to 8 feet. Seasons of flowering and fruiting, March and the hot weather. Fairly common in the Ruby Mines Division, Katha, where it occurs on the plain and low hills. Average height 40-60 feet. Flowers early in the year.

Andamans.—Met with as a small tree in fair abundance in the belts of dry deciduous forests of the islands. Of these forests Padauk (**Pterocarpus dalbergioides,** *Kurz*) is the principal species. The tree extends from sea-level to about 400 feet and attains a size of 8 feet in the girth breast high, and 35 feet in height.

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ODINA Wodier. | Jingan Gum.

Properties and Uses.

GUM.

I.—Gum.—From wounds and cracks in the bark of this tree, at some seasons of the year, there issues a GUM, at first yellowish white in colour (*kanne-ki-gond*), which takes on a brownish tinge, and afterwards, if it falls to the ground, becomes blackish (*jingan-ki-gond*). It usually exudes in October and "occurs partly in tears of a yellowish tinge, partly in colourless, angular fragments which are full of fissures like those of gum-arabic. It has a disagreeable taste, is not astringent; about one-half is completely soluble in water; the remaining portion forms a slimy mucilage, but is not gelatinous" (*Dymock*). It is much used along with the gum of **Anogeissus latifolia** in calico-printing, and in Nepál as a paper-size. In Kumáon **Captain Campbell** states that it is mixed with lime in white-washing. In Burma, **Kurz** says, it is employed as the basis of an inferior varnish. The Brahmins of Bengal use it to stiffen their Brahminical strings.

The following recent provincial notes regarding the gum may be here recorded :—

Panjab.—The gum is very little used. It does not, so it is said, exude, naturally, but only on incision of the bark or as the result of an injury obtained chiefly during the rainy season. A full size tree is said to yield about ½ a seer (1 lb.) of gum per annum. The cost of collecting and landing at Railway station is estimated at about ₹50 per 100 lbs. A fair amount could be collected from the Division if required (*Kangra Division*). The gum is collected and sold in the bazars. It is used for adhesive purposes, in lime-washing and in calico-printing. It is, however, usually mixed with other gums, especially those of **Buchanania latifolia, Anogeissus latifolia,** and **Boswellia serrata.** The gum does not exude naturally from the tree but only in consequence of an injury. The method of tapping adopted locally is to cut a notch about 2 inches deep in the tree. The gum then exudes and hardens, when it is scraped off. The trees are notched in February-March, and the gum collected in May-June. It is hard and of a yellowish white colour, but that which exudes in the rains, and becomes mixed with water, is blackish. It is said that about 2 lbs. of gum can be obtained annually from one tree. The possible annual yield may be roughly stated at about 400 lbs. At present no regular trade exists, the gum being collected by the villagers in small quantities only. The price may be given as

R12 per 100 lbs. landed at the nearest Railway station, *viz.*, Jagadu, 30 miles from Kalesár (*Kalesar Reserved Forest, Umbala District*).

Madras.—Not used either commercially or for domestic or medicinal purposes (*Ganjam District*). The gum is not collected. It exudes naturally from faults in the trunk. Trees that are quite sound yield no gum. The latter can be obtained in the hot season from March to May. A tree yields from two or three ounces to 2 lbs. of gum. The average would be about ½ a lb. A hundred pounds could be delivered at Rajahmundry at a cost of R3-12. This taluq could probably supply about 200 candies (1 candy = 200 lbs.) annually (*Bhadrachallum Sub-Division, Godaveri District*). Not collected or used. It is reported that in old and mature trees the gum exudes naturally and in others if the bark is injured. In mature trees gum exudes all the year round (*Madura District*). Gum is not systematically collected, but it is available in the bazars. Exudes only by injury—natural or artificial—by wear and tear of sun and rain or by cuts in the bark with an axe. Obtained in all seasons by injury, but considered to be most abundant in the cold and rainy season—August to February. A tree in good condition would probably yield 6 lbs. of gum yearly. In Sreeharikota the cost of carriage on 100 lbs. to the Buckingham Canal is estimated at six annas. The corresponding charge in the case of gum from Veligonda and Zerrakonda forests would be R3. About 70 lbs. of gum could be collected in Sreeharikota, but the production in other parts cannot be estimated. The gum is occasionally used for cloth-printing (*Nellore District*). The gum exudes naturally and also at times from wounds made in the bark by cattle graziers. No gum was obtainable from incisions made in September and October 1897 : a quantity was found to have exuded naturally during February and March following (*North Arcot*). Not collected or used. The gum exudes by injury done to the bark (*South Coimbatore*). The gum is not collected or used. It is reported that the gum exudes in the rainy season, generally in consequence of some injury—by wounding the bark. The average yield per tree is estimated at not more than an ounce. (Trichinopoly.)

Cloth-printing.

Burma.—The gum is not collected or used. It does not exude naturally but from wounds. The gum is probably most plentiful in the rains (*Pegu Division*). Thought to exude only in consequence of some puncture. The latter may be the result of cuts, breakage of branches or small punctures made by birds. Unhealthy trees are reported to exude more than healthy ones. The gum is obtainable at

ODINA Wodier.

Jingan Gum.

PROFESSOR DUNSTAN'S REPORT.

any season (*Rangoon Division*). Not usually collected or used by the villagers. The gum seems to exude in consequence of some natural injury, and even then not at all times of the year (*Thayetmyo Division*). Not collected or used for any purpose. The gum exudes from wounds and cracks in the bark. It is obtainable from October to April (*Henzada-Thôngwa Division*). Not collected or used for any purpose by the Burmese. The gum exudes naturally (*Lower Chindwin Division*). Not collected or used. It is thought, however, that a considerable quantity could be obtained without difficulty (*Yaw Division*). The gum is not collected or used. It exudes naturally about the months of March and April. About 25 lbs. of gum may be got from a good sized tree in a year. This estimate is probably over the mark. The gum could be landed at the nearest steamer ghat 32 miles distant at from R3 to R4 per 100 lbs. (*Magwé Division*). Trifling quantities of the gum are collected for local consumption. There is no trade in the article. It is used for making an inferior kind of varnish. The gum exudes probably in consequence of some injury, but the tree is not wounded for the purpose. It is usually gathered after the close of the rains (*Mandalay Division*). Not collected or used locally. It exudes naturally during the rainy season (*Pyinmana Division*). Not used for any purpose (*Ruby Mines Division, Katha*).

Varnish.

Andamans.—The gum exudes from the bark naturally and is used by the Andamanese for keeping their fires alight. The gum is obtained at about the commencement of the dry season.

Report by* PROFESSOR WYNDHAM R. DUNSTAN, F.R.S., *Director of the Scientific and Technical Department of the Imperial Institute, on some Indian Gums.

"The gums which have been examined are described in a letter from **Dr. George Watt** to **Mr. Royle,** dated the 2nd June 1896, which enclosed a copy of a memorandum, No. 286, dated 29th June 1895, from **Mr. Gamble**, Conservator of Forests, School Circle, North-West Provinces and Oudh, on the subject. **Mr. Gamble** stated that the local demand for the following gums, which are procurable in the forests of the Saharanpur Division, is not very good, and that it would be advantageous if new and better markets could be found for such products. At present the supply is limited, but if new markets

could be found, the supply of certain kinds, especially those of *Jingan* and *Pial*, could be greatly increased."

[The four gums contributed by Mr. Gamble and reported on by Professor Dunstan were as follows:—**Bauhinia retusa, Odina Wodier, Buchanania latifolia, and Boswellia serrata.** The present review deals with only the second of that series, and the passages in Professor Dunstan's Report that refer to the others will be excluded from the present paper.—*Ed.*]

Odina Wodier.

"The specimen consisted of small rounded tears and angular fragments with a few large irregular masses. The tears were opaque and fissured, the fragments, translucent, the gum had very little taste, and varied from white to yellowish-white in colour. The gum contained 12·3 per cent. of moisture and the ash in the dried gum amounted to 3·73 per cent. The gum was completely soluble in twice its weight of water, forming a rather thin mucilage, which possessed considerable adhesive power. The viscosity of the mucilage, compared with good gum arabic, is given below. The watery solution answered the ordinary tests for gum arabic, except that it had a marked reducing action on Fehling's solution, indicating the presence of a sugar. A solution made with boiling water and cooled, was unaffected by iodine, showing the absence of starch and similar constituents.

"***Comparative determinations of viscosity.***—The viscosity of the solutions yielded by these gums compared with that of a solution of the best gum arabic, was approximately determined by noting the time taken by 50 c. c. of a 10 per cent. solution to run from a burette fitted with a fine jet. . . . The following table gives the results obtained :—

	Strength.	Burette time in seconds.
Acacia Arabica (Gum arabic) .	10 per cent.	78
Odina Wodier (*Jingan*) .	10 „	58
Buchanania latifolia . .	10 „	184
Baukinia retusa . . .	5 „	200

"It appears from these results that a solution of the gum from **Odina Wodier** possesses about three-fourths of the viscosity of a similar solution of gum arabic.

"The only previously recorded examination of these gums seems to be that by **Dr Rideal** in 1892 (*Journal of the Society of Chemical*

PROFESSOR DUNSTAN'S REPORT.

Industry, Vol. II), who was furnished with small samples by Professor Pedler of Calcutta. Although it is evident from the preliminary results recorded by Dr. Rideal that the gums examined by him were the same in origin as those now under notice, it is obvious that their quality is different and usually inferior. It is important that attention should be paid in the future to the exportation of gum of uniform quality.

"Since the commercial value of the gums of the Acacia type must depend on other circumstances than those connected with their chemical properties, as, for example, colour, size, freedom from contamination with extraneous substances, etc., it was thought desirable to obtain the opinions of several of the best known London dealers in gums. They were each supplied with small representative samples of the three gums, and were asked to furnish a report on their probable commercial value. The four reports which have been received may be summarised as follow:—

"1. These brokers report that **Odina Wodier,** chiefly on account of its solubility, would be the most readily saleable. . . .

"2. The brokers report that there is on the English market a large quantity of all kinds of East Indian gums, which renders it very difficult to dispose of inferior qualities. The only sample which they consider would command a free market is that of **Odina Wodier.** . . **Odina Wodier** is compared with Cape gum, and, like it, might be used for preparing pale-coloured mucilages, and for mixing with gum acacia to reduce the cost of the latter. Its value is stated to be between 25*s.* and 30*s.* per hundredweight. These brokers remark that it is desirable, when introducing a new gum, to ship it in large quantities of not less than, say, 5 tons, as English consumers will not trouble to substitute new gums unless they are certain of obtaining a constant supply of average quality.

"3. The brokers report that all the samples are of inferior quality. **Odina Wodier,** which they remark has been carelessly collected and is largely mixed with earthy matter and wood, would fetch from 20*s.* to 25*s.* per hundredweight.

"4. **Odina Wodier** is the most valuable of the three samples submitted, but its appearance is much against it. If a constant supply could be obtained and if more care be taken in collecting it, it could probably be sold at from 30*s.* to 35*s.* per hundredweight.

O. 38-49.

Jingan Gum. (*W. R. Yates.*)

ODINA Wodier.

"It will be seen from these commercial reports that it would be worth while to pay some attention to the exportation of **Odina Wodier,** but it would evidently be necessary that greater care should be taken in the collection of the gum, and that the inclusion of extraneous matter should be avoided. It would probably be desirable to pick out the better pieces which are nearly free from colour, and send them as a separate consignment as first quality, the coloured and contaminated fragments being included in a separate consignment of second quality. One firm of brokers who reported on the samples, offered to take charge and dispose of any consignments of these gums which may be sent to this country."

PROFESSOR DUNSTAN'S REPORT.

II.—Dye and Tan.—The BARK of the tree furnishes a small amount of brownish-red colouring matter, which produces on tasar silk a golden or pale brown tint similar to that obtained from *lodh* bark **(Symplocos racemosa)** (*Wardle*). It is also used in tanning.

DYE AND TAN.

Madras.—The bark is employed for tanning purposes (*Nellore*).

Burma.—The bark is used for making boats (*Thayetmyo Division*). The bark being thick and fibrous is employed instead of hides to protect the elephant's back from the weight of the dragging chains (*Minbu Division*). The bark is said to be mixed with **Acacia Catechu** in Cutch boiling, but this requires confirmation (*Pyinmana Division*).

III.—Fibre.—The BARK yields a good or tough coarse cordage fibre.

FIBRE.

Madras.—The bark affords a fibre (*Nellore District*).

Burma.—The bark fibre is used in connection with ploughs and elephant gear (*Thayetmyo Division*).

IV.—Medicine.—The BARK is very astringent, and although not officinal is described in the *Pharmacopœia of India.* A decoction is said to be useful as a local application in cutaneous eruptions and obstinate ulceration, and to form an excellent astringent gargle. **Ainslie,** who gives a similar account of its properties, remarks:—"The bark powdered in combination with *margosa* oil is considered by the *Vytians* a valuable application for old and obstinate ulcers." The GUM, beaten up with cocoanut milk, is applied to sprains and bruises, and the LEAVES boiled in oil are used for a similar purpose. It is given internally in asthma, and as a cordial to women. Externally it forms

MEDICINE.

ODINA Wodier. — **Jingan Gum.**

MEDICINE. the basis of many of the plasters employed for rheumatism. In Taylor's *Topography of Dacca* mention is made of a medicinal use of this tree not referred to elsewhere. He says that the JUICE of the green branches, in a dose of four ounces mixed with two ounces of tamarinds, is given as an emetic in cases of coma or insensibility produced by opium or other narcotics.

Panjab.—The gum is used in native medicine (*Kangra*).

Madras.—The gum is stated to be applied medicinally to sprains and bruises, after being beaten up with cocoanut milk. Bark and gum are demulcent and tonic, respectively. The pounded bark boiled in or mixed with oil is applied to ulcers and wounds. The bark forms a gargle and is used for decoction (*Nellore District*). The bark is used for skin eruptions and for local injuries, such as wounds and bruises. It is beaten with a stone and then applied to the affected part (*Madura District*). The JUICE of the bark is said to be administered to children as a tonic (*South Coimbatore*). Pounded up with old rags it is said to be used as a plaster for wounds (*Trichinopoly*).

Burma.—The juice of the bark is applied to swellings (*Pegu Division*). The bark is boiled in water and the decoction employed for dressing sores (*Pegu Circle, Rangoon*). A decoction of the bark is used for toothache (*Thayetmyo Division*). The bruised bark is applied by villagers to sores (*Mandalay Division*).

The leaves are used for all local swellings and pains of the body. They are first boiled and then applied (*Madura District*). The leaves after being pounded are applied to sores (*Pegu Division*). They are used as medicine for children (*Thayetmyo Division*).

FODDER. *V.—Fodder.*—The LEAVES and young SHOOTS afford fodder for cattle. In some places (Madras, Oudh, etc.) it is pollarded to supply fodder for elephants (*Gamble*).

Panjab.—The leaves along with those of other trees are extensively lopped for grazing purposes by shepherds and others (*Kangra Division*).

Madras.—It is reported that the bark is given to elephants for the purpose of improving their digestion. Leaves are used for fodder (*Nellore District*).

Burma.—Leaves or branches are readily eaten by elephants (*Pegu Circle*).

Jingan Gum. (*W. R. Yates.*)

ODINA Wodier.

It is said that sometimes silk-worms are fed on the leaves, but only very seldom (*Lower Chindwin Division*). Silk-worms.

Lac forms on the twigs and some (not a large proportion) of the stick-lac brought down from the Shan States is *hnabe* lac (*Mandalay Division*). Lac Insect.

TIMBER.

VI.—Structure of the Wood.—The sapwood is large in amount and very subject to the attack of worms; the heartwood when freshly cut is light red, but becomes reddish brown on exposure. It is moderately hard, close-grained, seasons well, and does not warp, but is not very durable (*Gamble*). It is, however, not liable to be attacked by white-ants (*Gazetteer, Mysore and Coorg*). Average weight about 58 lbs. the cubic foot.

The following passages may be here usefully recorded from the recent correspondence that has taken place on this subject:

Panjab.—The timber is of inferior quality; only the heartwood is used. There is very little market for it. Occasionally exported in small quantities to the plains. The price locally is R1 per tree, or for local use 4 annas. Planks of the timber are said to warp considerably if not properly seasoned. Occasionally brought and taken by river to Ferozepur and elsewhere where it is sold to Zamindars, so it is stated, at four annas per *karri* of 2 cubic feet (nearly) (*Kangra Division*). The sapwood is whitish, and the heartwood reddish brown. It is hard and heavy. It is not attacked by white-ants. Better species being readily obtainable, there is no trade in the timber (*Kalesar Reserve, Umbala*).

Madras.—Only a very small local trade. The best only fetches about annas $3\frac{1}{2}$ per cubic foot in the market (*Ganjam District*). The timber is not at all appreciated owing to the abundance of better kinds. It is said to be notorious for its want of strength and durability; never used for construction or other work, as it is soft wooded by nature (*Madura District*). Not used for building purposes (*Nellore District*). Useless for building construction (*North Arcot District*). The wood is very light and white in colour. No trade exists (*South Coimbatore*). The timber is not used. Not strong nor durable and is liable to attack by white-ants (*Trichinopoly District*).

Burma.—Sapwood rather light, and of a whitish colour, turning pale brown: heartwood heavier, close-grained, of a reddish brown colour. Weight per cubic foot 65 lbs. (*Kurz*). It is very durable. Some house posts here—still in good condition clean of sapwood

ODINA Wodier.

Jingan Gum.

Domestic.

and having a girth of 2 feet 3 inches to 3 feet 4 inches—have been in use over 30 years. When dry it floats. Trees of large girth are rare in these forests, but logs below 4 feet 6 inches in girth could be supplied in considerable numbers. There is no special trade in the timber. It is sold in lots mixed with other less valuable woods. The rate varies considerably from R600 to R1,000 per 100 logs averaging 6 feet to 7 feet 6 inches girth and 18 feet length (*Pegu Division*). There is no trade in the timber (*Pegu Circle*). The timber rots very quickly in the ground or if exposed to the weather. It is used only when no other can be obtained (*Thayetmyo Division*). Not regarded as very durable. A large quantity could be supplied if wanted. The cost of delivery on the river bank would be about R3 to R4 per log. There is no trade in the timber at present (*Henzada-Thôngwa Division*). The timber is said to be of rather poor quality. Scarcely any trade in it (*Lower Chindwin Division*). The supply greatly exceeds the demand. There is no trade (*Yaw Division*). The sapwood is said to be subject to attacks of white-ants (*Minbu Division*). Very little used locally as the wood is said to be too soft. There is no trade in it (*Magwé Division*). The wood is hard and is considered imperishable in the ground as boundary posts. It fetches from R12-8 to R18 per ton in Mandalay where over 50 tons are sold annually (*Mandalay Division*). Very seldom used and no local trade in the timber (*Yamethin District*). The wood does not seem to be used nor is there any trade in it (*Ruby Mines Division, Katha*).

VII.—Domestic Uses.—The wood is used for a variety of purposes. Spear shafts, scabbards, wheel spokes, cattle yokes, oil presses, and rice pounders are made of it. It was tried for sleepers on the Madras and on the Oudh and Rohilkhand Railways, but did not succeed. Kurz recommends it as suitable for cabinet making; but no trial of the wood for that purpose has apparently as yet been made.

Panjab.—The heartwood is used for small *karris*, doors, planks etc. (*Kangra Division*). Sometimes used by the villagers for making, clod crushers. It is of course used as fuel as are all the other species found in the mixed forest of this district (*Kalesar Reserve, Umbala*).

Madras.—Chiefly used for planking (*Ganjam District*). Yokes are sometimes made from the timber owing to its lightness (*Madura*

Jingan Gum. (*W. R. Yates.*)	ODINA Wodier.
District). Used for fuel and various agricultural implements, such as yokes, etc. (*Nellore District*). Employed for the making of bedsteads, posts for fences, and water-lifts (*Trichinopoly District*).	Domestic.
Burma.—Chiefly used in house building as posts, beams, rafters, etc., and as handles for *dahs* (*Pegu Division*). Used locally for house building (*Henzada-Thôngwa Division*). The timber is said to be of rather poor quality. The chief use to which it is put is in making Burmese drums. Also occasionally used for coffins (*Lower Chindwin Division*). Chiefly employed for handles of *dahs* and *dalwés* (*Yaw Division*). Sometimes used in agriculture for rollers to break up clods of earth (*Minbu Division*). Now and then used for house planking, making bedsteads, etc. (*Magwe Division*). Used for sandals, *dah* scabbards, rice mortars and oil presses (*Mandalay Division*). Not used except very occasionally for oil-presses (*Yamethin District*).	
It will thus be seen that the very greatest difference of opinion prevails regarding the timber of this tree, but upon the whole it is not held in high esteem.	

G. I. C. P. O.—No. 2563 R. A.—11-10-1960.—2,230.

THE AGRICULTURAL LEDGER.

1900—No. 17.

DENDROCALAMUS STRICTUS.

(MALE BAMBOO.)

[*Dictionary of Economic Products, Vol. III.*, D. 292-325.]

BAMBOO MANNA*:

Its OCCURRENCE in the CENTRAL PROVINCES.

By Mr. D. Hooper, F.C.S., F.L.S.

Origin of the term.

Tabashir.

A substance called "Bamboo manna" has been known for many years among native physicians in India, but the term is generally accepted to be the silicious concretion found in the culms of the bamboo and called *Banslochan* or *Tabáshir*. Tabáshir is a peculiar substance, and its origin is not satisfactorily determined. It occurs inside the stems of various species of bamboo, either in thin fragments or in masses about an inch thick. It is often mixed with dead insects in the stems, but when calcined it becomes opaline or pure white. Extraordinary properties have been attributed to it, and it is said to be tonic, cooling, aphrodisiac and pectoral, but from its composition it would appear to be quite inert as a medicinal agent. At any rate the trade in the drug has decreased within the last few years, and its collection by wild tribes is not by any means so active as it formerly was.

* A review of this paper was unfortunately sent to *Nature* by Mr. D. Hooper some weeks before submission of the original for publication in *The Agricultural Ledger*. This explanation is necessary to obviate its being supposed that the one publication had derived its information from the other.—*Editor.*

DENDROCALAMUS strictus. **Bamboo Manna : its Occurrence**

Tabashir.

The Sanskrit name for Tabáshir is *tvakkschira* or "bark milk." This derivation would signify an exudation taking place on the outside of the stem, but tabáshir is invariably found inside the stem, probably the residue of the watery liquid occasionally found in the hollow internodes. Bamboo manna would convey the idea that the substance is sweet, but tabáshir is perfectly tasteless like all other silicates. The confusion doubtless arose from this product of the bamboo being called saccharon by **Dioscorides** and **Pliny**. Saccharon of the ancients had none of the properties of sugar and was used in quite a different connection, especially as a medicine. **Dioscorides** says: "What is called σαχχαρον is a kind of concrete honey, found in reeds in India and Arabia Felix, in consistence like salt, and brittle between the teeth like salt." A brittle substance occurring inside the stem of a reed is evidence more of tabáshir than of sugar or manna (*Sir George Birdwood, Bombay Products*). In the Dictionary of Economic Products (Vol. I., page 385), attention is drawn to a passage in the "System of Botany" edited by **La Maout** and **Decaisne** in which a reference is made to a sugary pith which under certain circumstances exudes from the nodes of certain species of bamboo and which becomes solidified into pure sugar, in distinction to the silicious concretion of *tabáshir* found within the stems. Indian travellers, and the most recent writers on the subject of Bamboo, however, have never recorded the spontaneous excretion of a substance similar to manna appearing on the stem. The only portions of the bamboo used for food are the young shoots and the seeds. The seed which appears after flowering, after long and irregular intervals, is used in times of famine as a food grain, this has been known to sell for 40 to 50 seers per rupee, while wheat was selling for 12 seers. Further particulars with regard to Tabáshir or Bamboo manna may be found in an article by **Sir D. Brandis** in *The Indian Forester*, March, 1887, and by **Professor J. W. Judd**, in *Nature*, March 24th, 1887, page 488.

Botanical reference.

The occurrence of a true manna on the bamboos of the Central Provinces is accordingly exceedingly interesting. A sample of this nature was recently received by the Reporter on Economic Products to the Government of India, and which I had the pleasure to have had sent to me for examination and report with a view to publication in *The Agricultural Ledger*.

With these introductory remarks the interesting note received along with the sample may be here recorded.

D. 292-325.

in the Central Provinces. (*D. Hooper.*) **DENDROCALAMUS strictus.**

Mr. Lowrie's description.

Mr. A. E. Lowrie, Forest Divisional Officer, Chanda, Central Provinces, in a letter dated the 17th March 1900, gives the following particulars of its discovery :—

"The year being an abnormally dry one, the entire bamboo (**Dendrocalamus strictus**) areas of forest for some miles along the Wardha river from about 10 miles above its junction with the Wainganga river to right opposite Sirpur in Hyderabad flowered in November last year, and consequently the whole area was shedding ripe seed from early in January which is quite unusual. This has been a great source of food for thousands of poor people in the district during this famine year, and has been tiding them over for the last three months. About the middle of last month I went through the area of bamboo-seeded forests and found that, though most of the bamboo clumps were far advanced in seed, small stretches of it were still flowering, and, strange to say, in the dryer portions of the forest on poor soil, very stony and chiefly laterite. It was while passing through one of these tracts that I noticed the culms in the clumps streaked all the way down with what appeared to me to be a white brittle gum, similar to what one sees exuding from **Odina Wodier.** On asking some of the Gonds (local men) who were with me, what it was, they could not tell me and had never seen it before. I at once collected some, and on tasting it found that it was perfectly sweet. The men then began collecting it by handfuls. I also collected some and send you a tinfull in case you would care to have it. On reaching camp I got hold of a number of villagers both Gonds and others, and on enquiry they told me they had never seen or heard of this gum. I passed through a number of similar stretches in which the bamboos were covered with the gum. This sugary deposit only extended for about 5 feet along the culms and was entirely absent towards the tops, it was found both at the nodes of the bamboo as well as on the stems between the nodes. I am sure this has nothing to do with any insect deposit, nor has it been caused through the aid of insect punctures in the stem of the bamboo as I made a careful examination of a number of culms. The culms also were old ones, one, two and three years old."

Resemblance to gum.

Not of insect origin.

Description of manna.

The manna was in the form of cylindrical or flattened pieces of about an inch long, white or brownish in colour, with a slight peculiar odour and a sweet taste. It dissolved readily in half its own weight

Description of Manna.

of water, but was insoluble in alcohol, ether and chloroform. It afforded no crystals of mannite when boiled with rectified spirit and allowing the solution to cool. Crystals of sugar separated when the filtered syrup of the manna was left to evaporate at the ordinary temperature of the air. These crystals melted in an oil-bath when raised to 160°C., and a little above this temperature assumed a brown colour and the consistence of barley sugar.

Analysis of the manna.

The solution had a dextrorotatory action on polarised light. The saccharine solution was inverted when boiled for 20 minutes with 1 per cent. hydrochloric acid. These re-actions point to the presence of a saccharose, related to, if not identical with cane-sugar, as the chief constituent of the manna. An analysis revealed the following centesimal composition :—

Water	2·66
Glucose	·75
Ash	·96
Sugar	95·63
	100·00

The exudation is in this case quite wholesome and might with impunity be used for cooking or making sweetmeats in the place of ordinary sugar.

Other Indian mannas.

Saccharine exudations are afforded by many trees in the East and are appreciated more or less for their medicinal virtues. The three chief mannas imported into Bombay, and used in India, are *Taranjabin*, *Guzangabin* and *Shirkhist*.

Taranjabin.

Taranjabin is obtained from the Camel Thorn (**Alhagi camelorum** and **A. maurorum**) growing in Persia, it is called "Manna of the Desert" and consists of a peculiar

Guzangabin.

sugar called melezitose and cane-sugar. Guzangabin, a product of Persia and Arabia, is collected in June from the Tamarisk (**Tamarix gallica,** *Linn.*). This manna has been found to consist of cane-sugar,

Shirkhist.

inverted sugar, dextrin and water. Shirkhist is the name for the white granular masses found in Persia on the shrub, **Cotoneaster nummularia,** *Fisch. et Mey.*). These mannas are valued in the East for their aperient, expectorant and tonic properties, and their supposed virtue in strengthening the liver, stomach and intestines.

Mannas of minor importance are those secreted by the Pines (**Pinus excelsa**) in the Himálayas, the **Eucalyptus viminalis**

in the Central Provinces. (*D. Hooper.*) DENDROCALAMUS strictus.

on the Nilgiris, and the Wild Plantain (**Musa superba,** *Roxb.*) in the Bombay Presidency.

The European manna is chiefly derived from the ash of Sicily (**Fraxinus rotundifolia**), and occasionally there is collected what is known as Briançon manna from the larch trees (**Pinus Larix**) of the South of France.

G. I. C. P. O.—No. 116 R. & A —26-9-1900.—2,230.—W. B. G.

THE

AGRICULTURAL LEDGER.

1900—No. 18.

BŒHMERIA NIVEA.

[*Dictionary of Economic Products, Vol. I.*, B. 576-606, *also Vol. VI. Pt. I.* (*Rhea*) R. 172-213.]

RHEA (RIHA) OR CHINA-GRASS.

Correspondence between MESSRS. THIRKELL & CO., *London, and the Imperial Institute on the subject of Rhea Ribbons.*

With a view to make **Messrs. Thirkell & Co.'s** offer as widely known as possible, the appended correspondence is published as a supplement to *The Agricultural Ledger* No. 15 of 1898.

Those who are desirous of instituting experiments in the production of Rhea ribbons may communicate, through the Reporter on Economic Products or direct, with **Messrs. Thirkell & Co.**, as they think best.

No. I. S. C. 102-99, dated London, S. W., the 17th November 1899.

From*—J. R. Royle, Esq., C.I.E., *Secretary and Curator, Indian Section, Imperial Institute, S. W.,

To—The Reporter on Economic Products to the Government of India.

I have the honour to forward herewith a copy of a letter just received from **Messrs. Thirkell & Co.**, stating that they are prepared to take at about £15 per ton, all the Rhea ribbons that India can produce for some years to come, and saying that they prefer the fibre in the ribbon stage instead of having it further prepared in India. If required, they are able to supply decorticators at about £40, which are capable of preparing about 10 cwt. per day.

Enclosure (A), dated 16th November 1899.

RHEA FIBRE.

In explanation of their reference to previous correspondence, I enclose also a copy of the firm's report on a sample of Rhea ribbon No. 4259, which was received by me a year ago from Messrs. R. G. Shaw & Co., of 88, Bishopsgate Street Within, and said to have been produced on their Assam Estates.

Enclosure (B), dated 16th November 1898.

I am informed that the present is a new demand which is likely to be permanent and which will not interfere with previous uses of the fibre, and I shall be glad to hear at an early date if you think it likely that India will do anything to meet the demand.

ENCLOSURE A.

Dated the 16th November 1899.

From—Messrs. Thirkell & Co., *155, Fenchurch Street, London,*

To—J. R. Royle, Esq., C.I.E., *Secretary and Curator, Indian Section, Imperial Institute, S. W.*

Referring to our Report on No. 4259, Rhea Ribbons from Assam, dated 16th November 1898, which we beg to confirm.

Will you please make it known to whom it may concern that we are prepared to contract for all the Rhea Ribbons that can be grown in India for years to come at about the price named £15 per ton.

A new use has been found for Rhea for which very large quantities are required—we have orders to purchase all we can get at moderate prices. You may confidently recommend the Government to foster the cultivation as much as possible.

We prefer the Rhea in the bark, that is, what the trade call "Rhea Ribbons," the crudest form in which the Rhea can be shipped—thus obviating any large initial outlay for plant and machines. We can supply decorticators to pass about 10 cwt. per day at about £40 each—the Rhea can be decorticated on the field and requires only to be thoroughly dried and may be press-packed as tightly as jute.

You may refer to us any one wishing to grow, or ship Rhea, and we will satisfy him of our ability to take all he can sell. May we ask you to pass this information on to other Sections of the Institute so that the growth of Rhea may be increased in all countries. We want, and shall want for some years to come, all the Rhea the world can produce, at moderate prices. We may add, the buying of Rhea for this new purpose will be solely in the hands of the writer.

Rhea (Riha) or China-Grass. **BŒHMERIA nivea.**

HOME MARKET.

ENCLOSURE B.

Dated the 16th November 1898.

From*—Messrs. Thirkell & Co., *155, Fenchurch Street, E. C., London,
To*—J. R. Royle, Esq., C.I.E., *Secretary and Curator, Indian Section, Imperial Institute, S. W.

We have examined your sample No. 4259, Rhea Ribbon, from Assam—this sample is of fair length, strong and apparently of good quality. We would recommend your correspondents to send to us direct a small quantity in first instance free of charge to enable us to get the fibre tried by manufacturers. If this sample parcel works out satisfactorily, orders will probably follow—the present nominal value is £15 per ton with a downward tendency. Care must be taken to send fibre only from stems of mature growth, as even in length as possible—trouble has recently arisen with parcels sent long and short together. It is found that the short *immature* fibre is not only much more wasteful, that is, the ribbons yield much less fibre, but also the fibre obtained will not produce the same quality of yarn, and is in consequence of very low value. We would also repeat, that so soon as sufficient Rhea can be produced, it will probably be desirable to prepare the same on the spot, that is, to bring it to the condition of raw "China" grass. Those who were so strong a few months back in their opinion that they preferred Rhea in the Ribbon, seem to be backing down a little.

After the foregoing had been in type, **Mr. Royle** wrote under date 3rd August 1900, I.S.C. 124, as follows:—

With reference to your letters Nos. 2576-75 of 28th June and 2739-78 and 2740-75 of 12th July, I have ascertained from **Messrs. Thirkell & Co.**, that they have no Agents in India.

They tell me that the question of Decorticators generally does not even yet appear to be quite satisfactorily settled, but that they hope very shortly now to be able to recommend a good machine at about the price of £40.

In the meantime they consider **Faure's** (of which I enclose a prospectus) to be about the best, but it turns out not "strips" but fibre. In many districts, however, they believe that the Ribbons can be produced without machinery by merely stripping the stems by hand labour.

R. 172-213.

BŒHMERIA nivea. **Rhea (Riha) or China-Grass.**

RHEA. DECORTICATORS.

Faure's decorticator requires about one-horse power to drive it; the power can be provided by manual labour, but, at the high speeds, it is usually not satisfactory. If bullocks are used there is the disadvantage of frequent stoppings and starting, which throws the machines out of gear.

The price of £15 per ton *c. i. f.* quoted by Messrs. Thirkell in November last means delivered in London; they sold some at this price quite recently.

They now inform me that the large demand which they anticipated last year is still a matter of the future, but the big buyers now again inform them that they hope *very shortly* to be able to give orders and credits for a regular supply.

Apart from this, they consider that the cessation of shipments from China, and the absence of stocks in Europe generally, justify them in maintaining that there will be a large demand for Rhea before the cultivators can produce it in sufficient quantities.

Any further information shall be forwarded as soon as received.

R. 172-213.

(122)

G. I. C. P. O.—No. 197 R. & A.—5-11-1900.—2,230—W. B. G.

THE AGRICULTURAL LEDGER.

1900—No. 19.

DAIRY FARMING AND DAIRY PRODUCE.

[*Dictionary of Economic Products, Vol. III.*, D. 15a.]

COMPOSITION OF INDIAN COWS' AND BUFFALOES' MILK.

By DR. J. WALTER LEATHER, PH. D., F.I.C., *Assistant Agricultural Chemist to the Government of India.*

Present knowledge.

The information on the composition of Indian Cows' and Buffaloes' Milk is very meagre. One analysis of cows and one of buffaloes' milk was published in the Proceedings of the Madras Board of Revenue in 1892 (*vide* Board's Proceedings No. 387, dated 25th May 1892) and the *average* composition of each kind of milk is published in Mr. Collins' *Agricultural Chemistry*, page 28. The latter were deduced from a number of analyses which Mr. Collins made at Poona, but unfortunately the Note Books containing the details were lost in transit by rail in 1898.

England. Composition of cows' milk.

The composition of cows' milk has been found in England to be very regular for different breeds, and to possess a relationship between the several component parts for all the breeds. It is of importance to know whether these relationships hold good for Indian breeds of cows and to what extent they vary in the case of the buffalo.

The analyses published by the Madras Board of Revenue are only two in number and are therefore quite insufficient for the purpose in any case. In addition, however, they show the proportions of Proteids and Lactose to be altogether different from anything met with in the case of English cows' milk.

ANALYSES OF MILK.

That of cow and buffalo compared.

Mr. Collins found, on the other hand, that the composition of th milk of the several breeds of cows at Poona coincided with that o English breeds. The milk of the buffalo he discovered was character ised by a high proportion of butter-fat and considerably more Proteid than that of the cow. Owing to the loss of the detailed notes, i seemed to me very desirable that the work should be repeated, and i the following pages I give the composition of the milk of some of th cows and buffaloes at Poona and that of the cows at the Saidape Agricultural College Farm. This information is set out in the accom panying Statements Nos. I., II. and III.

English Analyses.

It has been found in England that (*a*) there exists a relationshi between the Solids-not-Fat, the fat and the specific gravity, and (*b* between the proportions of Proteids, Lactose and Mineral matter (ash and that these relationships are constant, within certain limits, for al the several breeds.

Formulæ.

Richmond. Leonard.

Regarding the former, several formulæ exist. That of Richmon (*vide* "Analyst," Vol. XX., p. 57) is expressed, thus :—S = ·25G + ·2F + ·14. Another recently worked out by Leonard is expressed :—F = $(T-\frac{G}{4}) + (0{\cdot}3 - 0{\cdot}004T - 0{\cdot}01G)$ where T = Total Solids; S = Solids-not-Fat; F = Fat; G = the excess of gravity over 1,000. Th latter formula gives results which differ only slightly from Richmond's The proportions of Proteids, Lactose and Mineral matter in Englis cows' milk has been found to be approximately as 9 : 13 : 2. It is o interest then to consider in how far those relationships hold good fo Indian cows' milk.

Specific Gravity.

In the case of the Poona cows' milk, the specific gravity was no determined, but this was done for the milk at Saidapet. The result are set out in the lower part of Statement No. III., from which it will b seen that the relation between the Solids-not-Fat, the Fat and th Specific gravity is the same as it is in the milk of English cows, th variation between the proportion found by analysis and that calculate by Richmond's formula lying within the error of experiment. Similarl in the lower part of statement No. II. is set out the proportion o Solids-not-Fat found and calculated for those buffalo milks in whic the specific gravity was determined at Poona, and here also th relationship holds good and is the same as for English and India cows' milk.

Regarding the relation between the proportions of Proteids, Lactos and Mineral matter, Statement No. IV. exhibits it for two samples o

the average milk of the Poona cows, for three samples of the average cows' milk at Saidapet, and for the average buffalo milk at Poona.

Statement No. IV.

Proteids, Lactose, Mineral, ratios of.

	Cows' milk, Poona, average, 6th February 1899.	Cows' milk, Poona, average, 28th February 1899.	Cows' milk, Saidapet, average, 29th Mar. 1900.	Cows' milk, Saidapet, average, 4th April 1900.	Cows' milk, Saidapet, average, 7th April 1900.	Buffaloes' milk, Poona, average, 6th March 1899.
Proteids . .	9·20	9·25	8·66	8·71	8·74	10·78
Lactose . .	12·86	12·72	12·25	13·25	13·31	11·33
Mineral matter .	1·94	2·03	2·09	2·04	1·95	1·89

From these figures it is evident that in this respect also, the milk of the Indian cow corresponds to that of the English one, and that the proportions of Proteids, Lactose and Mineral matter is approximately as 9 : 13 : 2.

In the case of the buffalo milk the relationship is different, that of Proteids being distinctly higher, that of Lactose lower, than in cows' milk.

Generally, it may be said that :— Conclusions.

(*a*) the milk of the Indian cow contains a high proportion of butter-fat, varying from 4 up to 6 per cent. Buffaloes' milk contains usually much more, varying from 5 or 6 per cent. up to as much as 10 per cent. ;

(*b*) the percentage of Proteids (Albumen and Casein) usually varies in cows' milk from 3·1 up to 3·5 ; in buffaloes' milk from 3·5 up to 4·3. The buffalo, Nevasi, was exceptional. Such proportions as 5·0 and 5·2 per cent. of Proteids as stated in the Madras publication referred to, are never found ;

(*c*) the percentage of milk sugar (Lactose) in the cows' milk varies from 4·4 to 5·0, and in buffaloes' milk it is present in about the same proportion. It is never so low as is stated in the Madras publication ;

(*d*) the percentage of Mineral matter in cows' and buffaloes' milk varies from about ·7 to ·8 as it does in English cows' milk.

In conclusion, I have to express my thanks to Mr. Krishna Praebu and Mr. Ramalinga Iyer, of the Saidapet Agricultural College, for valuable assistance in the analyses of some of the milks.

DAIRY Farming.

ANALYSES OF MILK.

Composition of Indian

Statement No. I.—Composition of Cow's Milk. Poona, 1899.

	Janki, 1st March.	Sind Cows.							Half-bred Deccani Kalyani, 31st January 1899.	Aden Cows.		Aden-Sind Yammein, 4th February 1899.	Average milk of cows, 6th February 1899.	Average milk of cows, 28th February 1899.
		Janki, 24th January 1899.	Samarath, 25th January 1899.	Samarath, 26th January 1899.	Samarath, 27th January 1899.	Sunda, 28th January 1899.	Sabni, 30th January 1899.	Bhawa, 1st February 1899.		Nermada, 2nd February 1899.	Karangi, 3rd February 1899.			
Water	87·35	87·51	85·76	85·88	85·67	86·82	84·72	85·27	84·89	86·68	87·27	86·02	86·35	86·32
Fat	3·46	3·65	4·89	4·88	5·20	4·10	6·11	5·59	5·77	4·43	4·28	4·64	4·75	4·91
Proteids	3·65	3·16	3·68	3·61	3·54	3·14	3·62	3·55	3·89	3·06	2·76	3·35	3·31	3·33
Milk Sugar . . .	4·88	4·65	4·37	4·56	4·56	4·58	4·13	4·65	4·04	4·85	4·80	4·86	4·63	4·58
Mineral Matter . . .	·72	·68	·71	·78	·86	·69	·77	·67	·74	·69	·66	·83	·70	·73
TOTAL .	100·06	99·65	99·41	99·71	99·83	99·33	99·35	99·73	99·33	99·71	99·77	99·70	99·74	99·07
Solid-not-Fat . . .	9·19	8·84	9·35	9·24	9·13	9·08	9·17	9·14	9·34	8·89	8·45	9·34	8·90	8·77

D. 15a.

Cows' and Buffaloes' Milk. (*J. W. Leather.*)

Statement No. II.—Buffaloes' Milk. Poona Herd.

	Jaffarabadis.				Sairatis.		
	Nevasi, 6th February 1899.	Nevasi, 13th February 1899.	Champa, 7th February 1899.	Thami, 10th February 1899.	Kevada, 8th February 1899.	Phonga, 9th February 1899.	Mangal, 11th February 1899.
Water	86·43	85·09	82·84	84·05	82·63	83·38	81·74
Fat	4·08	5·78	7·32	6·89	7·74	6·86	8·66
Proteids	3·29	3·24	4·36	3·53	3·75	3·99	4·32
Milk Sugar	5·12	5·09	4·42	4·70	4·94	4·70	4·66
Mineral Matter	·80	·68	·75	·82	·68	·72	·80
Total	99·72	99·58	99·69	99·99	99·74	99·65	100·18
Solids-not-Fat	9·49	9·13	9·84	9·06	9·63	9·76	9·60

	Nevasi, 28th Febuary 1899.	Gaura, 2nd March 1899.	Jamadar, 3rd March 1899.	Kaoli, 3rd March 1899.	Bhadra, 4th March 1899.	Asmen, 4th March 1899.	Gulab, 6th March 1899.	Mixed milk of Kirkee Buffaloes.	Reklimi. 6th March 1899.	Avadi, 7th March 1899.	Chandi, 7th March 1899.
Water	85·78	82·16	80·16	81·57	82·89	81·15	82·63	82·22	82·74	82·52	83·23
Fat	5·17	8·14	9·95	8·79	7·56	8·81	7·59	8·09	7·42	7·52	6·95
Proteid	3·31	4·33	4·04	3·86	3·62	4·31	4·39	4·34	3·91	3·89	3·89
Milk Sugar	4·97	4·27	4·58	4·66	4·87	4·61	4·89	4·56	4·65	4·60	4·67
Mineral Matter	·70	·77	·79	·71	·71	·76	·73	·76	·81	·80	·75
Total	99·93	99·67	99·52	99·59	99·65	99·64	100·23	99·97	99·53	99·33	99·49
Solids-not-Fat found by analysis	9·05	9·70	9·87	9·64	9·55	10·04	9·78	9·69	9·84	9·96	9·84
Specific Gravity at 15·5 °C	1,034·5	1,032·1	1,031·2	1,032·0	1,032·9	1,032·9	1,032·7	1,032·1	1,034·3	1,033·8	1,033·9
Solids-not-Fat calculated by Richmond's Formula	9·79	9·79	9·93	9·90	9·87	10·12	9·83	9·78	10·19	10·09	10·00

DAIRY Farming.

ANALYSES OF MILK.

Composition of Indian Cows' and Buffaloes' Milk.

Statement No. III.—Composition of Cows' Milk. Saidapet.

	Average Milk of Herd, 29th March 1900.	Average Milk of Herd, 4th April 1900.	Average Milk of Herd, 7th April 1900.	Baggeon II, 28th March 1900.	Govendi, 2nd April 1900.	Parvati, 3rd April 1900.	Munachu II, 5th April 1900.	Poongan, 6th April 1900.	Munachu III, 9th April 1900.
Water	86.27	86.87	85.97	86.14	85.52	84.48	86.13	86.98	86.08
Fat	4.00	4.14	4.68	4.41	5.48	6.07	4.57	3.52	4.62
Proteids	3.15	3.16	3.23	3.23	3.14	3.27	3.44	3.27	3.25
Sugar	4.82	4.81	4.92	5.05	4.68	4.66	4.56	4.96	5.05
Mineral Matter	.76	.74	.72	.76	.70	.72	.77	.75	.77
TOTAL .	99.00	99.72	99.52	99.59	99.52	99.20	99.47	99.48	99.77
Specific Gravity at 15.5 °C . . .	1,033.5	1,032	1,032	1,033	1,031	1,033	1,032	1,034	1,033
Solids-not-Fat found by analysis . .	9.73	8.99	9.35	9.45	9.00	9.45	9.30	9.50	9.30
Solids-not-Fat calculated by Richmond's Formula	9.32	8.97	9.08	9.27	8.99	9.60	9.05	9.34	9.31

THE AGRICULTURAL LEDGER.

1900—No. 20.

(REPRINT FROM BOMBAY BULLETIN, No. 21.)

AGRICULTURAL IMPLEMENTS.

(GRUBBER, ETC.)

[*Dictionary of Economic Products, Vol. I.*, A. 647.]

MANUAL POWER TILLAGE IMPLEMENTS.

Note by J. W. MOLLISON, ESQ.,M.R.A.C., *Deputy Director of Agriculture, Poona.*

Introductory.

The mortality amongst cattle in Gujarát has been great, and there will be great scarcity of work cattle for tillage operations during the next sowing season. It has, therefore, been considered necessary to determine whether ordinary native field implements can be so adapted that they can be worked by men without the aid of work cattle. I take no credit for initiative action. The enquiry was started by several people some months ago, in particular by **Mr. Whittle,** Wadhwán, and **Mr. Seddon,** Special Famine Officer, Káthiáwár.

Light plough of Gujarat.

2. The chief tillage implement in use throughout the Presidency is, of course, the plough, which in different districts varies very considerably in size, construction, and effectiveness at work. The lightest bullock-power plough in use is the Hal of Gujarát. But light though this implement is, I do not see how it can readily be adapted for manual draft. The plough is not used every year except in the deep alluvial sandy and loam soils of Northern Gujarát.

AGRICULTURAL Implements. **Manual Power Tillage Implements**

BOMBAY. Country harrow.

3. In many parts of the Presidency, particularly in black soil districts, the land is prepared for sowing at less expense by means of the ordinary country harrow called Vakhar in the Deccan and Karab or Rámp in Gujarát. The effective working part of this implement is an iron blade ranging in length in different districts from 2 to $\frac{1}{2}$ feet. This blade at work in the fair season scrapes the surface soil and fills the cracks which in black soil are large and deep. The Rámp works more effectively after the rains set in. It then penetrates and loosens the moist soil to a depth of about 3″ and prepares an excellent seed-bed in any description of soil.

Monsoon favourable to manual labour.

4. Fields are not likely to be prepared for sowing by manual power until the monsoon rains set in. The recent rain at Ahmedabad moistened the surface soil sufficiently to allow by means of manual draft a practical test with the Rámp and other implements. The Rámp which was used was lighter in all its parts, but otherwise similar in construction to the ordinary bullock-power implement, excepting that the neck yoke was replaced by a handle suitable for manual draft. The implement was tried in a field of sandy soil stocked to a considerable extent with Háriali (**Cynodon Dactylon**) and other deep-rooted weeds and grasses. The trial was made purposely severe. It was found that the blade did not penetrate the soil to any extent. It merely scraped the surface. It was possible by means of the guiding handle to lever the blade into the soil and thus increase its penetrative power; but then the draft became too much for four men. It became clear that sandy soil in weedy condition must be otherwise broken up before the Rámp could work effectively.

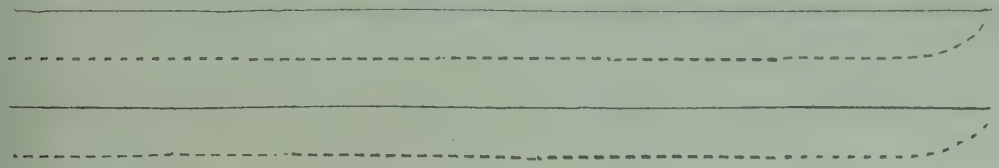
Failure of indigenous harrow.

Grubber made from country seed drill.

5. An implement with tines or teeth was considered necessary for the purpose. The ordinary country seed drill appeared to be suitable. It has tines or coulters which, as ordinarily worked, open furrows for the reception of seed. The seed drill is convertible into a "Grubber" by removing the seed bowl and seed tubes. The tines are of wood, pointed with iron. Weedy sandy soil, and I believe any description of soil in moist condition can be broken up very well by the tines of this "grubber." I first tried one with three tines placed a foot apart. The work was done well, but for four labourers was too heavy. I then tried a grubber with two tines set eighteen inches apart. This implement did excellent work and the draft was easy for four men. The furrows opened by this implement in the

EXPERIMENTS. Furrows.

forward journey across a field are shown below by straight lines and in the backward journey by dotted lines.



Thus, furrows were opened 9″ apart although the tines were actually 18″ apart and the soil between the furrows was also, to some extent, stirred. The handle which is used to guide the implement can also be used to lever the tines into the ground. This increases the depth of furrows. The grubber should first be worked lengthwise, then across a field and an interval of at least a day allowed between these operations. The work is heaviest during the first operation.

Ramp or harrow.

6. The Rámp works easily and well after the grubber. It should be worked (I at present think) along the furrows last made by the grubber. A practical test in the sowing season will determine the correctness of this conclusion. One turn of the Rámp was found sufficient. The soil was left friable to a depth of quite 3″ and in excellent condition for the reception of seed. The extent of preparatory tillage can very well be left to the option of the ryot.

Seed Drill.

7. The seed drill should, in drilling the seed, be worked across the lines made by the Rámp. The Rámp can be used after the drill to cover the seed and level the surface. This work can also be done by a plank roller (Samar) horizontally drawn over the surface.

8. The kind of seed drill to be used will depend upon the crop to be sown and the kind of soil. A three-coulter drill, lighter in construction but otherwise similar to an ordinary three-coulter drill with coulters 10″ or 11″ apart, will be suitable for sowing the principal *kharif* grain crops (bájri, jowár, kodra, etc.) in the sandy or sandy loam (Gorádu) soils extensively found in Ahmedabad, Kaira, etc. In any district, however, particular crop should be drilled in rows the usual distance apart, and suitable drills can easily be locally arranged for.

Three Implements put to practical test.

9. The three implements mentioned above, *viz.*, Grubber, Rámp, and a three-coulter seed drill, each constructed lightly to suit manual draft, were subjected to a practical test on a small plot of ground—2 gunthas ($\frac{1}{20}$th acre) in extent. The grubber was worked lengthwise and across the plot in 31 minutes. One turn with the Rámp took less than 14 minutes. The soil was now in good order for sowing as

BOMBAY.

proved by working the drill for two or three turns. The preparatory tillage was done at the rate of $\frac{2}{3}$ acre in a working day of 10 hours but the plot being small a good deal of time was lost through the numerous turnings. In actual practice in an ordinary field the work could have been done more expeditiously. A field prepared like the experimental plot could have been sown and the seed covered at the rate of 2 acres per day and under pressure at a still faster rate. The draft of the drill in well prepared soil is very light and four labourers pulling ought to swing along at a rapid pace, particularly in fields which are neither sticky nor wet.

How to substitute manual for bullock power.

10. Four labourers (women would probably work as well as men) were required for drawing each implement ; also a man to guide or steer. Each implement was fitted with a draft pole not quite so long or so heavy as required for bullocks, but fitted to the implement in precisely the same way as for bullocks. A stout handle or yoke about 4 feet long is adjusted to the draft pole in the same way as a bullock neck yoke. This handle is extended for two labourers, one on each side of the draft pole. They each grasp the cross handle or yoke with both hands and use their strength not by pulling, but by shoving. A rope attached to the body of the implement and extending beyond the length of the draft pole is fixed at its free end to the middle of a handle or yoke. The labourers, one on each side of the rope, grasp the handle with both hands and exert their strength by shoving like the pair of labourers working behind them. The draft rope should be looped up loosely to the draft pole to keep it in proper position.

Measures taken to extend the experiments.

11. Under the orders of the Commissioner, N. D., I have arranged to get a set of implements, such as I have described, made for each of the famine-affected Collectorates of the Northern Division, and I am also sending one set to **Mr. Seddon,** Special Famine Officer, Káthiáwár, the object being to give patterns which can be copied and possibly be improved upon by village carpenters. The implements, when sent, will be properly adjusted for work as regards means of draft, etc.

12. It is unnecessary at the present time to demonstrate how other tillage implements can be adapted for manual draft. The cultivators can, I believe, easily arrange for themselves regarding implements used for interculture and weeding. In fact I am not at all sure that a Gujaráti cultivator of average intelligence requires an object lesson to teach him how to apply manual draft to his tillage implement.

CONCLUSION.

13. It has been suggested that famine labour might possibly be profitably employed in field work with these implements after the rains set in, but I am of opinion that cultivators could make their own arrangements. The employment of home labour would be more satisfactory than hired labour. The work on account of rain would be intermittent and should be pushed on very rapidly when the conditions were favourable for working the land, and no doubt the working hours on particular days would be very long.

G. I. C. P. O.—No. 528 R. & A.—14-12-1900.—22,30.—B. N. D.

ate No. 1..... Two tined grubber.

late No. 2.....Ramp.

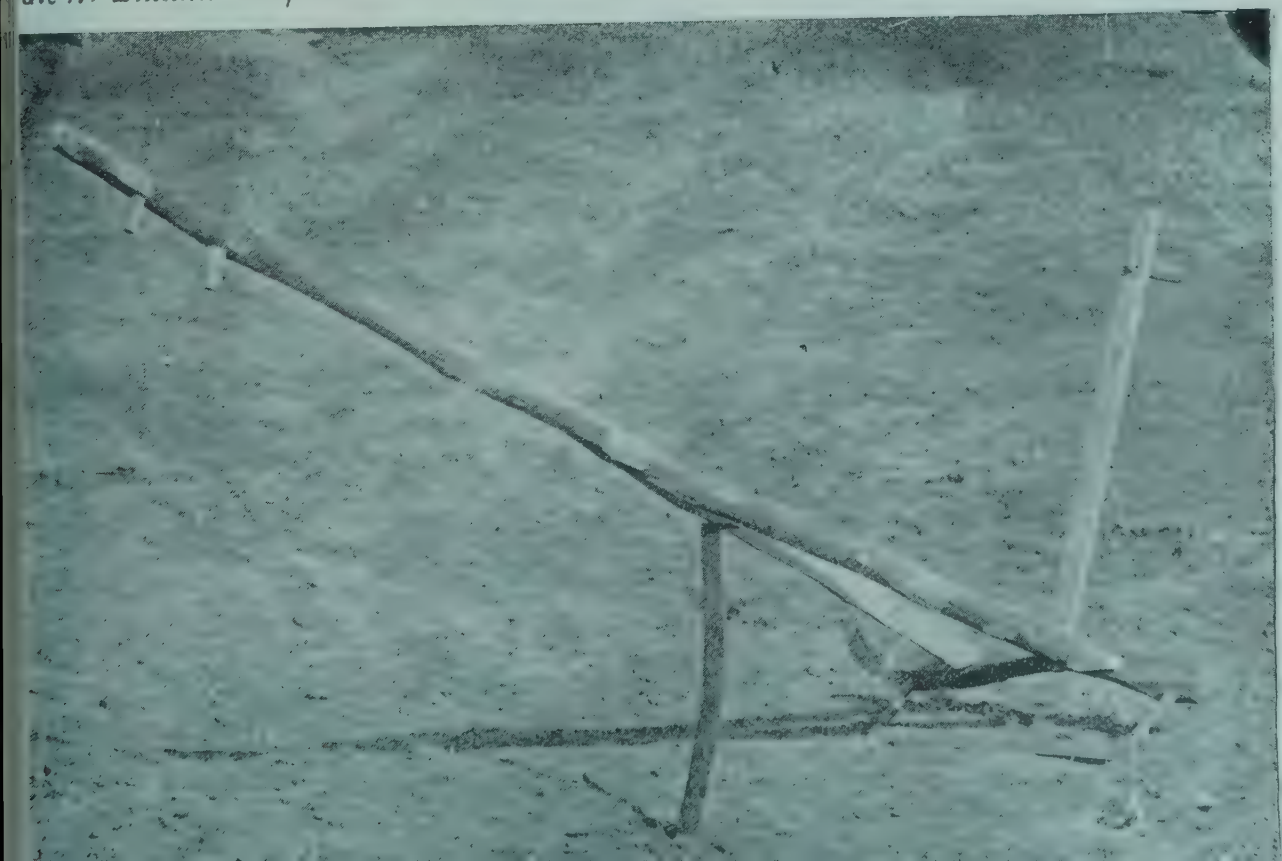


Plate No. 3.....Seed-drill.

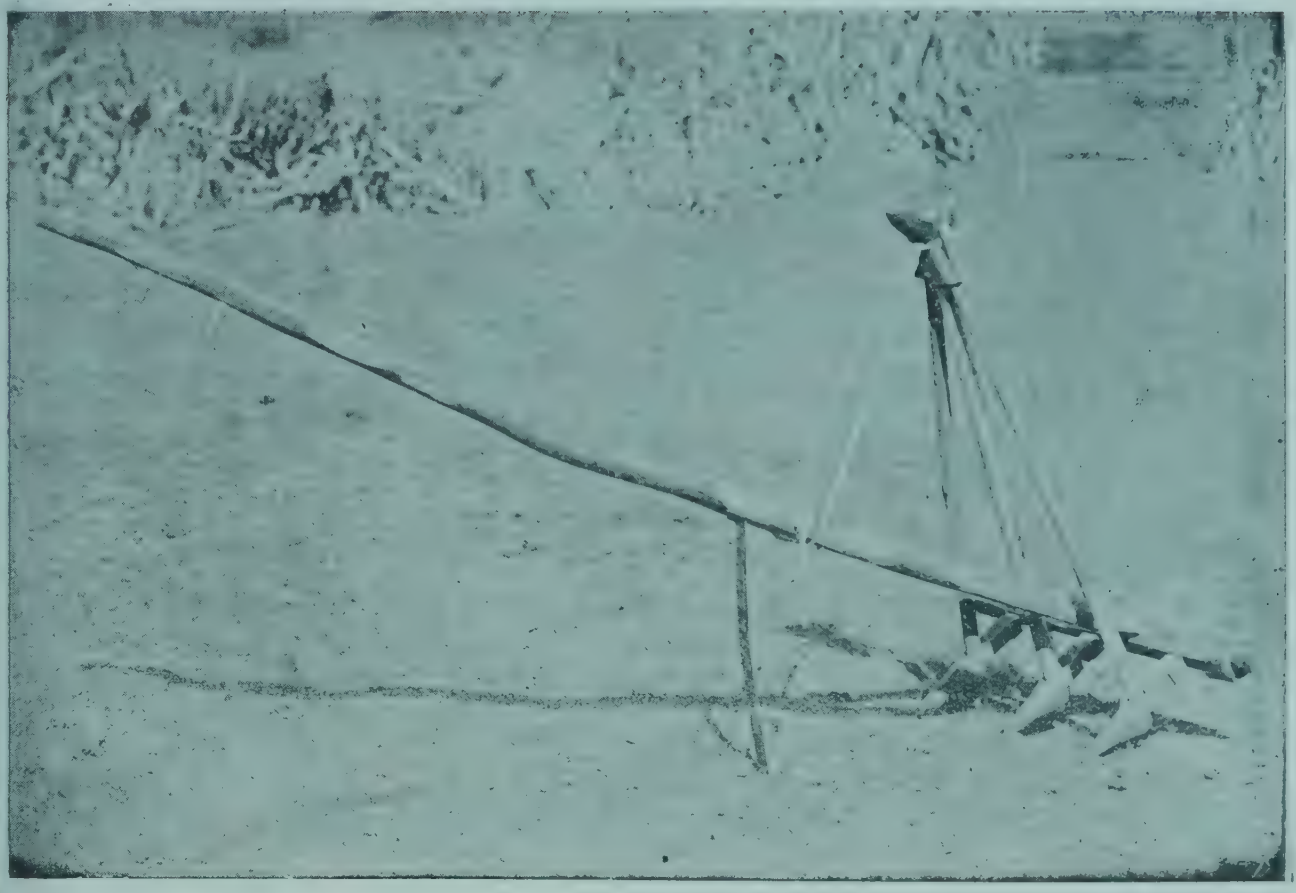
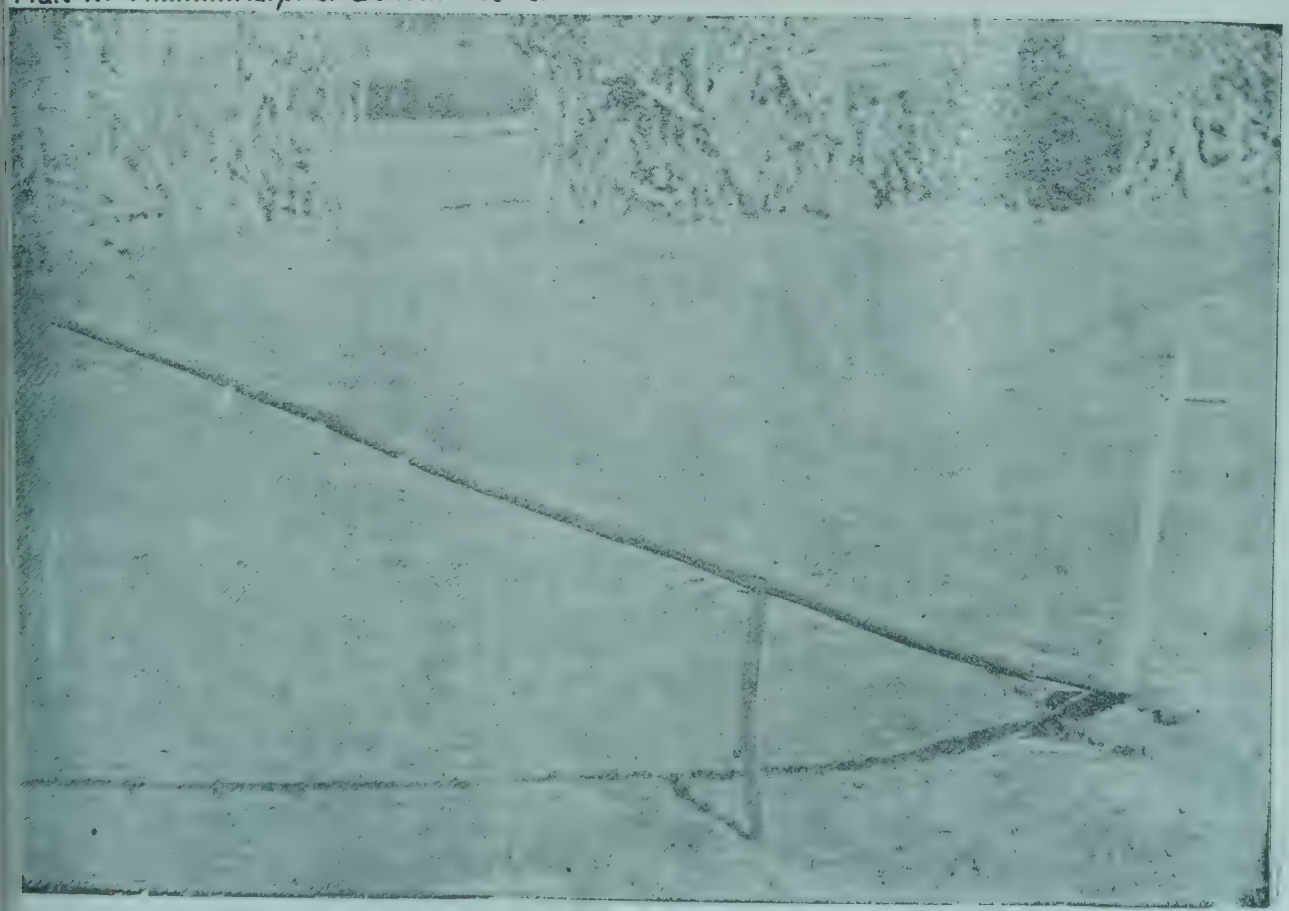


Plate No. 4.....Kurpi or Bullock hoe for interculture.



THE AGRICULTURAL LEDGER.

1900—No. 21.

OXEN.

[*Dictionary of Economic Products, Vol. V.*, O 551-94.]

THE CATTLE OF RAJPUTANA.

Beawar, *by* VETERINARY-MAJOR W. H. KEMP; **Marwar,** *by* COLONEL POWLETT, *Resident;* **Bikaner,** *by the Revenue Officer;* **Kotah,** *by* Colonel E. REYNOLDS, *Political Agent;* **Jaipur,** *by* COLONEL T. H. HENDLEY, I.M.S., C.I.E.; **Ulwar,** *communicated through the 1st Assistant to His Honour the Agent to the Governor General, Rajputana. Edited by* VETERINARY-MAJOR W. R. HAGGER, *Assistant to the Inspector General, Civil Veterinary Department.*

Introductory.

Of the following six Notes, on the Cattle of Rajputana, five have been furnished by resident officials, European and Native, of five Rajputana States, and one is by **Veterinary-Major W. H. Kemp,** late Superintendent, Civil Veterinary Department, North-West Provinces and Oudh.

Veterinary-Major Kemp in his Note on the Cattle of Beawar mentions two breeds, but strictly speaking, only one distinct breed of a uniform type exists in this part of India, *viz.*, the "Nagore," so named after the town and district of Nagore in Marwar, on the Bikaner border, where much attention is given to this celebrated breed.

"Rinda" is the local name for the common small village breed.

The "Sanchore" breed, mentioned by the Resident of Marwar are probably "Nagories," into which a strain of Gujrati blood has been infused.

The Note on the Cattle of Bikaner State, which is by a Native official, cannot be said to afford much definite information, either as

BEAWAR.

regards the breeds, rearing, or the utility of cattle in that State. The same may be said of the reports from Kotah and Jaipur.

In Ulwar, according to a report furnished through the Assistant to the Agent to the Governor General, Rajputana, three distinct breeds called Rath, Mewat, and Nahera, named after the districts in which they are bred, are recognised and cultivated by attention to breeding; but whether these can be considered to have a distinct and fixed type is doubtful.

NOTE ON THE CATTLE OF BEAWAR.

By **Veterinary-Major W. H. Kemp.**

There would appear only two distinct breeds of cattle in Rajputana, *viz.*, the "Nagore" and "Rinda." Local zemindars, however, recognise a third class which they consider is a separate breed, to which they give the name "Deswali," but which is really nothing but a cross between the two above-mentioned breeds.

The Nagore Breed.

Description of the Nagore.

So called after the town of that name in Marwar.

Head—well-shapen with a broad forehead tapering towards the nose, which ends in a clean cut muzzle, giving the animal a thorough-bred appearance.

Horns—small, particularly in well-bred animals, curving upwards and outwards and pointing inwards, thus making an attempt to form a circle.

Eyes—soft, quick, but not prominent.

Ears—long and pendulous.

Tail—flattened at root and set on rather high up.

Neck—short and strong.

Shoulders—sloping, withers surmounted by a well-developed hump.

Dewlap—thin and small, extending from the chin to the breast bone.

Back—straight, rising slightly towards the croup.

Chest—deep, with well-rounded ribs.

Legs—well-shapen, with fairly good bone.

Feet—hard, well-formed and black.

Height—about 58 inches.

The Cattle of Rajputana. (*W. R. Hagger.*) **OXEN.**

BEAWAR.

Colour—invariably white.

Disposition.

Good-tempered and docile, but timid.

Utility.

These cattle are much valued for their trotting qualities, on which account they are greatly sought after by the well-to-do natives, who drive them in "Ekkas" and "Raths."

Price.

A good pair from 4 to 5 years old will usually command from ₹100 to ₹150. A large number are sold annually at the Pushkar Fair near Ajmir.

Description of cows.

Cows.—The cows have all the leading characteristics typical of the breed, but they are smaller and shew more breeding than the oxen.

Milking powers.

In the hands of Native owners, even when she gets little else but grazing, a good cow will yield from 7 to 9 seers of milk daily.

The Rinda Breed.

Description.

"Rinda" means small, and cattle of this breed seldom measure more than 50 inches. In colour they are usually piebald or skewbald, whole colours being very rare.

Head—massive, with a prominent forehead.

Horns—thick and strong, but taking no definite direction, being sometimes curved backwards and inwards, and sometimes downwards.

Eyes—small, set deep within the sockets, giving the animal a heavy appearance.

Ears—long and pendulous.

Tail—long and whippy, ending in a tuft of long hair.

Neck—short and strong.

Hump—small, about 4 inches high.

Dewlap—thin, but of fair size.

Back—straight, but the quarters are somewhat drooping.

Legs—short and strong, with good forearms and thighs.

Feet—large and hard, rarely requiring to be shod even when the animal is worked on metalled roads.

Disposition.

Disposition—morose, obstinate and bad-tempered, sometimes showing fight when roused or when approached by Europeans.

Utility.

These cattle are used for all kinds of agricultural work, for which purposes they are in great demand by zemindars; they also make

MARWAR.

very good baggage animals, either in the plains or hills, being short legged and having short hard feet.

Price.

An average pair may be bought for about R75.

Description of cows.

Cows.—The cows are very wild and difficult to manage and they are poor milkers, but it is said that some animals remain in milk for two years if kept from the bull after calving.

NOTE ON THE CATTLE OF MARWAR.

By Colonel Powlett, *Resident.*

Breeds: Nagore and Sanchore.

There are two breeds of cattle in Marwar deserving of notice, those of the Nagore district in the north of the State on the Bikaner border, and those of Sanchore in the extreme south on the Gujrat border.

Sanchore may be said to be the great breeding place, and large numbers of the male calves produced there are sent to Nagore, where fodder is more abundant and superior, and where the people are apparently more careful of their cattle.

Nagore, Description of.

The Nagore bullocks are famous throughout India as magnificent trotting animals. Recently at a fair the Residency Surgeon, at my request, measured the finest bullock present, and found it stood 5 feet 10 inches measuring to the top of the hump, but I myself have not measured one more than 5 feet 9 inches, and the average height is 5 feet 6 inches. I have seen no Sanchore bullocks as large as fine Nagore ones. I presume there can be but little difference in shape between Nagore bullocks and those of Sanchore, as the former are often bred in the latter district, but the Sanchore bullock is said to be a superior animal to the pure Nagore.

The two compared.

I have had an opportunity of comparing good specimens of each breed. The Sanchore had much larger horns, slightly smaller ears, a broader chest, and a somewhat thinner tail. Its most remarkable distinction was the height of its back a few inches from the tail. At that point it stood higher than the Nagore bullock, though the hump of the latter was 3 inches higher of the two.

Cows.

Sanchore cows are decidedly superior to the Nagore cows as regards the yield of milk. From 6 to 10 seers is the daily quantity given.

Price.

The price of a well matched superior pair of Nagore bullocks is R200 to 400, that of a very good cow, R60 to 80.

BIKANER. Diseases.

Foot-and-mouth disease is less frequent and fatal in the dry region of Western Rajputana than in the Panjab and North-West Provinces. "Motarog" (pleuro-pneumonia) is said to be the most destructive cattle disease of the country.

NOTE ON THE CATTLE OF THE BIKANER STATE.

By the Revenue Officer, Bikaner.

Different breeds.

There are several breeds of cattle in this State, *viz.*, those of Bikaner itself, the "Sindhi," "Marot," "Sawal" and "Nagore." The "Marot" and "Nagore" breeds are to be found in the Nizamats of Suratgarh and Reni respectively, and those of the "Sawal" breed in the Nizamats of Reni and Sujangarh, while the "Bikaner" and "Sindhi" breeds are found throughout the State.

Breeding.

No attention is paid to breeding, and no bulls are ever imported into the State, breeding being left entirely to chance.

Owners of cattle.

The cattle are owned chiefly by "Raths" who make their living by the sale of milk, and of young male stock for agricultural purposes.

Management, feeding and breeding.

The cattle are for the most part kept in the jungle, and are only brought home to be milked, after which they return. They are seldom stall fed except in times of exceptional drought when grain and other food-stuffs are given. Water is given twice daily in the hot weather and once a day in the cold season, but when water is very scarce it can only be given once every third day.

Description.

Bikaner cattle are generally timid, but vicious. The prevailing colour is white, but black, red and dun are also sometimes met with.

The bullocks stand from 36 to 42 inches in height, have light necks, with no dewlaps.

Milking powers of cows.

Cows give up to 13 seers of milk per day.

Description.

"Sindhi."—The bullock has a massive frame, and stands from 45 to 60 inches in height. The horns are straight and of medium length, and the dewlap is thick and well developed.

Milking powers of cows.

The cow is docile, and measures from 36 to 50 inches high. Her udder is well developed with large teats. She is a good milker, giving up to 11 seers a day during the dry season, but when fresh grass is plentiful after the rains a good milker will yield double that quantity.

Price.

Cows will fetch from R20 to 60 each.

OXEN. | **The Cattle of Rajputana.**

BIKANER.

Marot cows, Description of.

"*Marot.*"—The cow is very docile, and in colour white or grey. She measures about 60 inches in height, and is well shaped.

Milking powers.

She will give from 3 to 11 seers of milk per day.

Price.

Her price is about ₹30.

Sawal cow, Description of.

"*Sawal*" cows are generally very vicious. Colour white, height about 60 inches. They have large ears which are pendulous.

Poor milkers.

The Sawal cow is a poor milker, seldom giving more than four seers per day.

Bulls.—The bulls are of the same kind as the cows but larger in size. No special attention is given to breeding. The bulls remain amongst the cows which they are allowed to serve with an absolute disregard of selection.

Utility and price.

Bullocks are used for agricultural purposes and also for well-work. "Nagore" bullocks are much valued for their trotting qualities by rich Natives who use them in Raths. A good pair wil fetch as much as ₹200.

REPORT ON THE CATTLE OF THE KOTAH STATE.

By Colonel E. Reynolds, *Political Agent.*

Mostly local breeds.

The cattle found in the Kotah State differ in no way from those of the surrounding States. They are mostly local cross-breds.

Description.

The ox stands from 50 to 54 inches behind the hump, which in the bull is about 6 inches high, but in the castrated bullock small and not more than 3 inches high.

The croup is round and droops gradually. The pelvis is broad, and the tail, though not so good-looking and whip-like as that of the Malwa ox, is not ugly. It ends in a tuft of hair generally of a black colour. The loins and back are fairly broad. The hind quarters are muscular and strong. The ears are small and drooping, and the eyes are bright.

The horns generally take an upward direction and when at their full length measure from 7 to 18 inches. The neck is short and proportionately thick, but it only attains to full development in the bull.

The dewlap measures about 23 inches. The sternum is broad and prominent. The shoulders are sloping. The legs are strong with the forearms ranging from 12 to 14 inches in circumference. The feet are strong and either black or brown in colour. The chest is round with a girth measurement of from 62 to 67

KOTAH.

inches. The ribs are broad and rounded. The sheath of the ox is small and close.

Disposition.

The village bullocks are usually gentle in temper. In the presence, or at sight of strangers, however, especially when they happen to wear white clothes, many of the young stock and some of the old ones show signs of excitement.

Castration.

Castration usually takes place when the animal is four years old by the method known as "crushing." The part operated upon is inflamed and painful, and for three days after the operation the animal eats scarcely anything. The bullock then begins to move about and mix with other cattle, and with the subsidence of the inflammation the pain gradually disappears, but the beast is not considered fit for work before the expiration of about twenty days.

Nature of work.

From the beginning of the Hindi month Jeyth (May and June) to the end of Kartik (November) is the busiest time for the plough bullocks, so that they have to work hard in the hottest part of the year. In other months they have little to do. But the bullocks belonging to the cultivators of poppy and sugar have to work almost all the year round, as no sooner is ploughing completed than well-work begins.

Feeding.

In the hot weather (from the middle of Baisak to the end of Sawan) 1 seer each of "Khal" (oil-cake) and "Binoda" (cotton-seeds) is given with one chittak of salt per head daily in the evening. In the rainy season a bullock is given 8 chittaks of oil once a month. In the winter, "Urd," oil and "Juar" are given for about two months.

Breeding.

The principles of breeding are entirely disregarded. Any bull that may have been turned loose on religious grounds is allowed free intercourse with cows irrespective of breed or quality.

Description of cows.

Cows.—The cows are generally inferior animals. They begin to breed when three or four years old, dropping a calf every second year. After calving they are given two or three seers of boiled wheat with 8 chittaks of *gur* for three days.

Management and feeding.

They are not stall-fed except when grazing is scarce in the hot weather when they are given "Karab" and "Bhusa."

The cows are very poor milkers seldom giving more than 3 seers of milk.

Price.

The average price is about R12.

JAIPUR.

Regarded as sacred

Buffaloes.—Male-buffaloes are dedicated to the goddess "Mata" and are called "Amara" (immortal) and are never worked except in isolated parts of the country. They are allowed to roam about freely and a ring is inserted in the lobe of the ear as a mark of their dedication to the deity.

Owned by Ghosis.

Female-buffaloes are owned chiefly by "Ghosis" for producing milk, and are valued at from R25 to R60.

NOTE ON THE CATTLE IN THE JAIPUR STATE.

By **Colonel T. H. Hendley, I.M.S., C.I.E.,** *Jaipur.*

Inferior breeds.

It appears that either the agriculturists are satisfied with owning very inferior breeds of buffaloes and cattle, or that they are not in a position to procure better.

No attention to breeding.

There are no very large herds belonging to single individuals, and funds are not available for keeping superior bulls for breeding purposes. The inhabitants of the villages trust entirely to chance whether the sire is good or bad, and, as castration is an offence against the law, the males whether they are healthy or unhealthy, strong or weak, are all entire. There is, therefore, no selection of any kind. In many cases the wandering Brahmini bulls do what is required, and the Bunneahs and Seths, who frequently own very fine Nagore bulls, allow them to be used for breeding purposes. It is illegal and severely punishable in the Jaipur territory to castrate or destroy the testicles of horses, bulls, or male-buffaloes in any way. The operation is however, no doubt, often done surreptitiously, but not sufficiently often to provide as much stock as is required, and particularly as many bullocks are required for the plough. The farmers, therefore, make large purchases from the fairs in adjacent States, and especially in the autumn from Parbtsir in Marwar. In the case of cows they procure superior animals from Hissar and the neighbouring Panjab districts.

Cattle and cows imported.

The proximity of Shekhawati, the northern part of the Jaipur State, to both Marwar and the Panjab accounts for the better class of animals which are found in that Province. It is stated that the principal reasons for the poorness of stock in Jaipur are—

Causes of inferior cattle.

(1) the practice of taking an undue proportion of milk from the cow, while the calf is young, for the sake of ghi or clarified butter which is produced from it;

(2) the want of good grazing grounds ; and

(3) the absence of large farmers who are capitalists. JAIPUR.

In Marwar, on the contrary, very little milk is taken for ghi, and in Nagore, in the north-eastern province of that State, whence the finest cattle come, there are good pastures on a marshy soil. I recollect hearing, when serving in Marwar, that it is a common practice to take calves born in Jalore in the south of the State to Nagore, very shortly afterwards, as it was found that unless this be done the animals do not grow so large nor make so much bone as the large and really magnificent beasts which have such high repute under the name of Nagore bulls.

Milking powers of cows.

The quantity of milk given by cows in Jaipur rarely exceeds five seers, and is generally much less, though in Shekhawati in the north, and in Malpura and Sambhar on the south and west, where the Nagore and Hissar breeds, respectively, have some influence, the yield is said to be higher and to approach even seven or eight seers.

Buffaloes.

As regards buffaloes there is nothing special to observe.

Cattle foul feeders.

Kine in the towns where sanitation is still much neglected, are very foul feeders. This may be a cause of disease amongst children to whom their milk is given, though the common practice of boiling the fluid no doubt minimises the danger.

At present public opinion will not admit of direct permission being given to castrate animals.

THE CATTLE OF ULWAR.

ULWAR.

Communicated through the 1st Assistant to His Honour the Agent to the Governor General, Rajputana.

In Ulwar where some of the best cattle in Rajputana are obtainable there are three distinct breeds known by the old names of the districts in which they are bred—

(1) Rath

(2) Mewat

(3) Nahera.

Rath, where bred.

The best of these is the Rath, which is said to be bred not only in the three north-eastern tehsils of Ulwar, but also in Narnol of Patiala, Kotputli of Jaipur and Rewari in the Panjab. The

OXEN.

The Cattle of Rajputana.

ULWAR.

Rath bullocks are of medium size, strong, well-shaped and good workers.

Utility and price.

There is a great demand for them for agricultural purposes, and in an ordinary year a good bullock fetches ₹150.

Description of Rath cows.

The cows have short horns and well-bred-looking heads, and give from 4 to 8 seers of milk. Their price varies from ₹30 to 40.

Care in breeding.

The zemindars of the Ulwar portions of the old Rath district are said to be careful to employ only the best bulls for breeding purposes. In India the quality of the local-bred cattle often largely depends on the "Binjar" bulls, *i.e.*, bulls let loose on religious grounds, and the excellence of the Rath breed may be partly due to the care taken to select only good bulls as "Binjar."

Binjar bulls.

The Mewati and Nahera breeds are inferior to the Rath.

Cattle fairs.

The three chief cattle fairs take place at Ulwar, Bahror, and Dhemi in the spring and autumn. The spring fair is the most important and on an average of 5,600 head are said to be brought to this show.

The Bahror Fair takes place in May, and about 1,800 head of cattle are brought for sale.

Prizes for cattle.

The Ulwar Durbar have recently decided to grant prizes amounting to ₹450 at these two shows.

O. 551-94.

(10)

G. I. C. P. O.—No. 372 R. & A.—10-1-1901.—2,230—B. N. D.

THE AGRICULTURAL LEDGER.

1900—No. 22.

OXEN.

[*Dictionary of Economic Products, Vol. V.*, O. 551-94.]

THE CATTLE OF MALWA AND OF H. H. THE NIZAM'S DOMINIONS.

Malwa, *by* COLONEL M. G. GERARD, C.B., *Officiating Political Agent.* **H.H. the Nizam's Dominions,** *by* MR. ALI ABDOOLA, *Superintendent of Stud and of Experimental Farm. Edited by* VETERINARY-MAJOR W. R. HAGGER, *Assistant to the Inspector General, Civil Veterinary Department.*

Introductory.

Considering that a recognised breed of cattle exists in Malwa having a distinct type of its own, the information contained in the following Note on the Malwa Cattle is regrettably small. Beyond stating that they are usually white in colour, no attempt is made to give a description of the leading characteristic features or habits of the breed. Professor Wallace * says:—

"Malwi cattle are a small white breed, reared chiefly in the Satpura hills. The bullocks are fine horned and make very good plough cattle. Many are imported into the Deccan every year by Banjaris.

"The appearance of the Malwi breed is quite characteristic. The horns of the male and female are set wide apart. In the cow they resemble two arcs of a circle set on the crest of the head with the concavity inwards. The dewlap is present though not large, while loose skin in the abdominal region is absent. The ears are neither large nor pendent, though set on so that they have a slightly downwards inclination."

* India in 1887.

OXEN. | The Cattle of Malwa and of

MALWA CATTLE.

MR. ALI ABDOOLA divides the cattle of the Nizam's Dominions into four classes, which he calls—

Teligana, Mahratwada, Lingrugoor and Elagandal, apparently after the four districts of these names. From his description of the prevailing colours, etc., some seem to have a strong strain of Mysor in them, some show a Deccani cross, while others seem to resemble the Malwi breed in some points.

NOTE ON THE CATTLE OF MALWA.

By **Colonel M. G. Gerard, C.B.,** *Officiating Political Agent.*

Description. The pure indigenous Malwa bullock is of medium size, measuring from 48 to 60 inches. The colour is generally white, with a tendency to a bluish tint on the neck, hump and knees.

Breeding. Cultivators are the largest breeders, particularly those who live near good grass lands.

In some places selected bulls are kept for breeding purposes.

Feeding. In villages, cattle are fed on grass, maize, and jowar stalks; in towns grain and oil-cake is given.

Castration. Some cultivators have hereditary religious prejudices against the castration of cattle, and rather than submit them to operation, sell them at a low price.

When castration is performed it is done at about 4 years old, by the process of "Crushing."

Shoeing. Malwa cattle being bred on hard stony ground, have very hard feet, and do not require shoeing even when worked on metalled roads.

Utility. They are very strong, but not swift, and are better suited to agricultural purposes than to any other kind of work.

Sale of cattle. Large sales of these cattle take place at fairs held periodically at Agar and elsewhere in Malwa. The purchasers come from Khandesh Guzerat and other places in British India. Prices range from R100 to R200 each.

Cows. ***Cows.***—The Malwi cow is smaller than the bullock. She is a poor milker yielding from 1 lb. to 6 lbs. of milk, but cows are not valued for their milking powers, breeding being the chief object of the cultivators.

Price. A good cow is worth about R25, but many inferior animals are sold for half that price.

H. H. the Nizam's Dominions. (*W. R. Hagger.*) OXEN.

HYDERABAD DECCAN.

Buffaloes.—The indigenous female buffaloes are neither remarkable for milking powers nor size. In villages many are kept for producing "Ghi" for the market. In towns for milk only.

They are fed on grass, cotton-seed and oil-cake. Prices vary from ₹20 to ₹50 each.

NOTE ON THE CATTLE OF HIS HIGHNESS THE NIZAM'S DOMINIONS.

By **Ali Abdoola**, *Superintendent of H. H. the Nizam's Stud and Experimental Farm.*

I have divided the cattle into four classes and propose to describe each class separately—

(1) ***Teligana.***—The Teligana bullocks are found within a radius of about 50 miles of Hyderabad in the Teligana district.

Description.

The prevailing colour is red, but brown is also frequently met with.

They are hardy and show good breeding; their average height is about 44 inches.

The cows are very poor milkers.

Cows poor milkers.

(2) ***Mahratwada.***—The cattle of the Mahratwada districts are much larger and heavier animals than those above described.

The bulls average about 51 inches in height, but the cows are smaller. Some young bulls are magnificent looking animals with hump from 9 to 10 inches high, and a deep dewlap. The best specimens are to be found between Beeder and Nundir.

The colours are black, brown, red and piebald.

Colours.

Price.

A handsome pair of young bulls have been known to fetch as much as ₹500.

(3) The cattle of Lingrugoor, Raichore, and Shorapur resemble somewhat those of Mysor, having sleek coats and long horns, which give them a well-bred appearance. They are larger, but not so hardy as the Teligana cattle.

Colour.

The colours are red, white and black.

Cows' milk powers.

The cows are better milkers than the two kinds above mentioned.

Great powers of endurance.

(4) ***Elgandal Cattle.***—The Elgandal district produces cattle possessing great powers of endurance for their size.

OXEN. | **The Cattle of Malwa and of H. H. the Nizam's Dominions.**

HYDERABAD DECCAN.

They are smart, intelligent looking little animals, very wild until broken to work. They are very fast and some have been known to trot 18 miles in three hours in a light "nib."

Smart and wild. Good trotters.

The Nizam's Government is now endeavouring to improve this breed by the introduction of Mysor and Mahratwada bulls, which, it is hoped, will increase their size.

Males, inferior animals. Uses.

Buffaloes.—The buffaloes of these parts are very small inferior-looking animals. The males are used for drawing water, ploughing and at Chunam mills, but very few can endure the sun.

Bad milkers.

The females are wretched milkers, giving only 3 or 4 seers only.

Diseases.

Rinderpest and Foot-and-Mouth disease usually attack the cattle in November if the season is wet, and in the hot months when they drink stagnant water. Steps are now in progress to prevent this.

O. 551-94.

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SACCHARUM OFFICINARUM.

(SUGAR-CANE.)

[*Dictionary of Economic Products, Vol. VI., Pt. II.*, S. 30-48; *Pests* (*Sugar-cane*), *Vol. VI., Pt. I.*, P. 433, p. 152.]

MOTH-BORER IN SUGAR-CANE.

Review of a Paper written by MR. H. MAXWELL-LEFROY *and issued by the Commissioner, Imperial Department of Agriculture for the West Indies, with special reference to the manifestations of similar Indian Sugar-cane-borers.*

INTRODUCTORY.

The Government of India in the Revenue and Agricultural Department have recently been favoured by D. Morris, Esq., LL.D., C.M.G., Commissioner, Imperial Department of Agriculture for the West Indies, with a copy of a pamphlet by Mr. H. Maxwell-Lefroy entitled "Hints and Suggestions for the Treatment of the Moth-Borer in Sugar-cane."

The borer there referred to is **Diatræa (Chilo) saccharalis** and is a different species from, though closely allied to **Chilo simplex**, *Butl.*, the most prevalent corresponding insect of the Indian Sugar-cane.* On this account it has been decided not to reproduce Mr. H. Maxwell-Lefroy's paper in its entirety, but to give those portions of it that seem likely to have a practical bearing on the extermination of the Indian Sugar-borer, with alongside such information as may be available, paragraph by paragraph, regarding the Indian pest. It is hoped that this treatment may not mutilate beyond recognition Mr. Maxwell-Lefroy's most interesting paper, while at the same time

* The identification of the Indian pest has been kindly furnished by the Entomological Section, Indian Museum.—ED.

SUGAR-CANE-BORER.

it may prove more interesting and useful to those concerned in sugar-cane cultivation in India.

Important reasons for fighting the pest.

In a short preface to Mr. Maxwell-Lefroy's paper Dr. Morris concludes as follows:—"There can be no doubt that the Moth-Borer is the most widely distributed and most destructive of all enemies of the sugar-cane. If the suggestions now made were fully carried out the planters would, within a short period, save hundreds of tons of canes, and possibly also assist in keeping in check the rind-fungus and other diseases." There can be no doubt that the most serious form of fungal sugar-cane disease, hitherto met with in India, is practically unable to attack the canes unless an entrance to the tissue of the stem be first afforded it by some injury caused by either an insect or some mechanical cause. This circumstance shows how exceedingly important Dr. Morris' observations on the practical aspects of Mr. Maxwell-Lefroy's careful study of the life-history of the West Indian insect may prove. But to turn to Mr. Maxwell-Lefroy's report itself, it may be said that after dealing with the history of the past attacks of insects on sugar-cane and the life-history of the moth-borer itself he gives the following table of the life-periods of the West Indian insect:—

Table of life-periods.

Stage.	Duration.	Where found.
Egg	6 days .	On the leaf.
Caterpillar	35 „ .	In the cane.
Chrysalis	7 „ .	Ditto.
Moth	2 „ .	Flying about.

Whether or not these periods apply to the Indian moth-borer does not appear to have been made out, but the table is suggestive.

Borer, when easily attacked.

Mr. Maxwell-Lefroy then continues:—"When the life of this insect is fully understood, it becomes clear that there are two periods of its life when it is easily attacked: (1) the eggs, which are laid openly on the leaves of the cane; and (2) the moths, which fly about. Any attempt to destroy the caterpillar or chrysalis would involve the destruction of the infested cane, which is practicable only in young canes which can be cut out, or very badly diseased old ones which should be removed and burnt."

HINTS and SUGGESTIONS.

Before proceeding farther with **Mr. Maxwell-Lefroy's** paper it may be desirable to give here the following passages from *The Indian Museum Notes, Vol. III., page 52*:— **Dr. Riley,** the United States Entomologist, writes:—"I must confess that I am rather disappointed in finding that your sugar-cane-borer is not the same as ours. It is a **Chilo,** and not a **Diatræa,** and comes near **C. plejadellus,** *Zinck.*, which bores into rice in our Southern States, but it differs in the very clear cut terminal dark line between the black spots and fringe. The specimen is badly rubbed, and I cannot be certain of its exact specific position. It is possible that it may be identical with **Chilo infuscatellus,** *Snell.*, which infests sugar-cane in Java. . . I believe that you are perfectly right in assuming that the borers in sugar-cane, sorghum, and maize are all the same, and it is interesting to know that at least one other crambid agrees with **D. saccharalis** in this particular."

Determination by Dr. Riley.

Little known of the Indian Insect

The greatest possible obscurity still pervades the whole subject of the Indian sugar-cane-borers, only this much apparently being satisfactorily made out that the chief borer is a species of **Chilo** not **Diatræa.** But it is not apparently known whether the eggs of the Indian sugar moth-borer are laid on the leaves or elsewhere. The subject is, therefore, well worthy of careful enquiry. **Mr. Maxwell-Lefroy** describes the eggs of the West Indian insect as being laid on the midrib both upper and under surfaces.

Parasitised eggs.

The eggs are about $\frac{1}{25}$ inch in size and are deposited in batches of from 6 to 57, or an average of perhaps 20 in each batch. He then alludes to a most curiously interesting circumstance, namely, that these nests of eggs are often parasitised, by which means they are destroyed and turn black. So far as can be learned no one would seem to have recorded the existence of black parasitised eggs in India.

Indian Sugar Borer,

In his "Conspectus of the Insects which affect Crops in India" (*Indian Museum Notes, Vol. II., page 162*) **Mr. Cotes** thus describes the Indian Sugar-cane-borer:—

Mr. Cotes' description

"**Diatræa saccharalis,** *Cotes* (Crambidæ).—The caterpillars of this moth are little white grubs, about an inch in length. They tunnel into sugar-cane **(Saccharum officinarum)** and maize stalks **(Zea Mays),** and do a great amount of damage in India. Closely allied or identical insects tunnel into sorghum stalks **(Andropogon Sorghum)** not only destroying much of the crop, but also rendering

SUGAR-CANE-BORER.

the plant unwholesome to cattle. The insect is said by **Duthie** and **Fuller** to be known by the natives of the North-West Provinces, in the case of sugar-cane as *silai*, and in the case of sorgum as *bhaunri*. The sugar-cane-borer has been reported from Baroda, where it was said to be known as *narkote;* from the Rungpur, Hooghly, and Burdwan districts, where it was said to be known as *dhosah;* from Mymensingh, where it was said to be known as *mandarnah;* from Ganjam, where it was said to be known as *manjikila purugu;* from Sibpur, where it was said to be known as *majera;* and from Cawnpore where it was said to be known as *reotha*. An allied caterpillar tunnels into the stems of brinjal **(Solanum Melongena)** plants; this insect has been reported from Ganjam where it is said to be known as *vanga purugu;* also from Berhampur and Ranchi."

Prevalent in many districts.

Mr. Maxwell-Lefroy gives the following practical information :—

REMEDIES.

Remedial measures.

"***Collecting Eggs.***—The simplest remedy is to collect the eggs and burn them. The young canes on the whole estate should be examined once a week by boys who must first of all be taught to recognise the eggs on the young plants. . . They should go systematically down the rows of canes, carefully inspecting every plant. They must examine both sides of every leaf, and on finding a patch of either cream-coloured, orange or orange and black eggs, the leaf should be cut off below the patch of eggs and put in a bag.

Gathering of eggs.

"The eggs that are cut off should be brought in and immediately burned.

"If it is remembered that there are on the average nearly 20 eggs in a patch, the number of eggs that can thus be easily and cheaply destroyed is seen to be very considerable."

"*If this remedy were adopted as soon as the young cane commences to show* and continued as long as the cane is sufficiently small, there would be no loss from 'cut-out' canes, and practically all the best shoots would not then have to be destroyed as at present."

* * * * * *

Good results of egg-collecting.

"The egg is the only stage that is appreciably affected in Barbados by any natural check, and it is reasonable to suppose that if egg-collecting is carried out intelligently and vigorously during the time the cane is growing, the ravages of the moth-borer will not only be greatly checked during the later growth of the cane, but in time the numbers of the moth-borer will be very greatly diminished."

HINTS and SUGGESTIONS.

Alluring of moths by night. Directions.

"***Destroying the Moths.***—A remedy that has been to some extent adopted is that of catching the moths at night by means of lights. If lanterns are hung out in fields of cane, the moths are attracted to the light and can be caught in pans of molasses or kerosene hung underneath. A useful arrangement consists of a wooden tray 2 feet square, 6 inches deep, with a light suspended above it. The tray may contain molasses or kerosene or either of these with water. Any arrangement that will keep burning all night and give a good light is all that is needed. A number of these should be placed on the estate near the patches of mature or growing cane, and they require little attention and need cost but little. This remedy is of especial use when the cane has grown too high for the eggs to be collected: but it may at all times be usefully applied to trap the moths that would otherwise lay eggs."

Cutting out dead-hearts.

"***Cutting out affected Canes.***—Another remedy already generally familiar is that of cutting out 'dead-hearts.' This term is applied to young shoots bored by moth-borer and the object of cutting them out is to destroy the caterpillar inside, though this is not so generally known as it should be. It is useless to cut out dead-hearts after the caterpillar has become the moth and flown away. There are three essential points: (1) Begin cutting out dead-hearts early; (2) continue cutting out regularly; (3) see that they are cut out quite low down, where the shoot comes off from the plant cane. It is evident that six weeks after the moth-borer gets in, it gets out in the form of the moth and lays eggs. It is useless, therefore, to put off cutting out dead-hearts till three months after the canes are up. Also, as the caterpillar is usually to be found quite low down, the dead-heart must be cut low down, or the caterpillar will not be killed."

Three important points.

Caterpillars to be killed immediately.

"When dead-hearts are cut out, they should be put in a bag and the caterpillar inside killed without delay. This may be done by feeding the dead-hearts to stock *on the same day that they are cut out.* Dead-hearts should never be left lying about to wither and rot on the land, otherwise the caterpillar inside will turn to the moth and escape, or it will walk out and attack the nearest cane plant. If the dead-hearts are not fed immediately to cattle or destroyed, they should be ripped up and the caterpillar inside killed. It is important to remember that the success of this remedy depends entirely on the destruction of the chrysalis, or caterpillar inside the dead-hearts."

SUGAR-CANE-BORER.

Roth on manner of controlling the pest in Queensland.

Mr. Maxwell-Lefroy next reviews former recommendations in dealing with the moth-borer after which he goes on to say—

"It will be useful to notice two cases mentioned in the *Kew Bulletin* (*1894, p. 103*). In Queensland, Roth describes how the pest is kept under control 'by sending boys with sharp pocket knives along the rows of cane. The boys detect the dead or dying shoots, and cut them off as close as possible to the parent cutting. They then opened the shoot and destroyed the fat grub.' This is an instance where the practice of intelligently cutting out dead-hearts proved successful. The following recorded by Dr. Morris shows what has been effected in the Canaries by methods based on a knowledge of the habits of the pest: 'In the south-western corner of this island (Teneriffe) a very large sugar estate has been established and is now under the management of Mr. Richard Tonge of the Icod and Danté Estate Company. On this estate the canes were very severely attacked by moth-borer, which was believed also to attack the maize crops of the island. The injuries to the sugar-canes were becoming yearly more and more serious. Mr. Tonge was in despair. He carefully studied the habits of the insects and then organised a system of treatment which was steadily pursued for two years. Every person engaged on the estate was taught to recognise at a glance the successive stages of the insect, *viz.*, the grub, the chrysalis, and the mature insect. A small sum was offered for these and payment was made at the close of each day. During one month (February 1893) there were destroyed 46,884 insects in various stages. During the rest of the year the numbers were not so large, but the record kept of them shows that 9,640 grubs were cut out of standing canes, 5,022 were destroyed in the chrysalis stage, and 1,144 moths were caught on the wing. By judicious management and personal influence Mr. Tonge has so thoroughly enlisted the interest of the work people that the moth-borer is becoming less and less plentiful. Its practical extermination on this estate is now only a question of time. The period during which the canes are growing appears to be the most critical time. Women and children are then kept regularly employed in cutting out any canes attacked by the moth-borer, and the grubs are destroyed in their burrows. This is regarded as a most effective plan. It is believed that if this plan alone were regularly pursued in the West Indies for two or three seasons the injuries would be reduced within comparatively small dimensions."—*Kew Bulletin, 1894, p. 174.*

Experience gained in the Canary Islands.

Collecting. Payment by results

Success of measures adopted.

"This plan would no doubt be still more effective if the eggs were collected regularly in addition to the other stages."

HINTS and SUGGESTIONS.

Conclusion.—"The three remedies given here—

1. Collecting the eggs.
2. Destroying the moths.
3. Cutting out affected canes,

The three methods which will ensure success.

if carried out energetically and intelligently from the first, cannot fail to destroy great numbers of moth-borers. Not only will the canes be more vigorous and sugar obtained that is now destroyed by millions of borer caterpillars, but the rind-fungus would, I think, be greatly diminished. Up to December in each year, rind fungus only gets into such young canes as have been bored by moth-borer (*Report of the Commission for Destroying the Borer and other Pests, Barbados, 1894, p. 3*). If it is possible by collecting the eggs, cutting out dead-hearts, and catching the moths at lights, to prevent the caterpillar from boring the canes, rind-fungus will no doubt be greatly diminished. Of all insect enemies of the sugar-cane the moth-borer is certainly the most serious in Barbados. It attacks all varieties of canes, and hence is not only constantly exposing them to the attack of Fungi or Bacteria, but would in many cases carry the very spores into its burrows; besides which, the injury suffered by any cane by the actual attack at least leads to impoverished juice, if not to actual death of the plant. A glance at any of the literature of the cane diseases will convince any one of the importance which every cane-growing country has attached to checking the spread of the pest (*Report of the Commission for Destroying the Borer and other Pests, Barbados, 1894, p. 15*).

Not only with the Borer but also with rind-fungus.

"The conclusion cannot be avoided that sugar planters can now choose between getting all the sugar their land will yield them, or letting the moth-borer yearly rob them of a large portion of their canes. Every cane that is bored will on being ground yield less sugar than it should, and will also give juice containing substances that tend to spoil the cane juice. Good sugar cannot be obtained from canes attacked by moth-borer or rind-fungus, as acids and other injurious compounds are formed as the result of the attack. It will well repay every one interested in sugar planting to see that these remedies are adopted immediately the moth-borer is seen to be at work in the cane-fields."

Uninfected cane gives better quality and bigger outturn.

SACCHARUM officinarum. **Moth-borer in Sugar-cane.**

The Editor desires to add, in this place, that he suspects a boring beetle (a species of **Xyleborus**) may be a very frequent forerunner of the fungal blight **Colletotrichum falcatum.** He had the pleasure to examine a very extensive series of diseased canes from all parts of India, and in the majority of instances the beetle, rather than the moth-borer, had prepared the way for the fungus. This circumstance seems worthy of careful consideration in any future investigations in the life-history of the fungal blights of sugar-cane in India.

S. 30-48.

(8)

G. I. C. P. O.—No. 373 R. & A.—4-1-1901.—2,230.—B. N. D.

THE

AGRICULTURAL LEDGER.

1900—No. 24.

MICA.

[*Dictionary of Economic Products, Vol. V.*, M. 508-13.]

ON SAMPLES OF MICA FROM JAIPUR.

Remarks on a letter in 'The Indian Agriculturist' for August 1900. By PROFESSOR WYNDHAM R. DUNSTAN, M.A., F.R.S., SEC.C.S., *Director of Scientific and Technical Department of the Imperial Institute. To which is prefixed a copy of the letter in question.*

Introductory remarks.

The report on Samples of Mica from Jaipur by Professor Wyndham R. Dunstan—*Agricultural Ledger*, No. 2 of 1900—has been handled somewhat severely in an anonymous communication to *The Indian Agriculturist*. The letter was made to form the text of a leading article in that Journal, thus giving the communication an importance which possibly it did not possess.

Under the circumstances it seemed desirable to forward the letter to the Imperial Institute for information and favour of any action that the authorities might see fit.

By the courtesy of Sir Frederick A. Abel, Bart., K.C.B., a reply embodying the remarks of Professor Dunstan on the letter referred to above has now come to hand.

In common fairness to Professor Dunstan, it has accordingly been decided to issue these papers, as a supplement to *Agricultural Ledger*, No. 2 of 1900. It is hoped that by doing so at least as much publicity may be afforded to Professor Dunstan's reply as was given to the letter which called it forth.

"TO THE EDITOR OF 'THE INDIAN AGRICULTURIST.'

Indian Agriculturist.

SIR,—I have just seen the *Agricultural Ledger*, No. 2 of 1900, on the subject of Mica. It professes to give *expert* opinion on a

MICA. | On Samples of Mica from Jaipur.

LETTER ADDRESSED TO

sample of mica submitted by the Dewan of Kishengarh to the Reporter on Economic Products with the Government of India. The mica was sent to the Honorary Secretary, Imperial Institute, London, and reported on by **Professor Wyndham R. Dunstan, F.R.S.** That report is now issued to the public in the *Agricultural Ledger*, and will be hereafter embodied in the Dictionary of Economic Products. It is a pity that instead of going so far afield as London, the Reporter on Economic Products did not seek expert opinion nearer home. Bengal is the chief seat of mica mining in the world. Calcutta exports more mica than all the other ports of the world put together. Its brokers have handled and sold more mica than the brokers of any other city. Its scientific men have personal acquaintance with the mines and mining men. Its merchants own the mines, and from constant dealing with the material know the best markets, and the mercantile value of any sample that could be submitted to them. Yet we find the Reporter on Economic Products ignore the valuable opinion available near at home in order to obtain a report which is erroneous, misleading, and likely to do harm. **Professor Wyndham R. Dunstan** says: "The mica experts report that the samples are quite worthless, their chief defect being that they are striated or cross-grained and much cracked. *This kind of mica is only adapted for electrical purposes.*" [The italics are mine.] Cracked, striated, and cross-grained mica is wholly unsuited for electrical purposes. Any electrical engineer would have told **Professor Dunstan** this, and I cannot conceive where he could have got this wholly incorrect information. On the strength of this report, coming from the source it does, miners, new to the business, may send home cracked, cross-grained, striated mica, for electrical purposes, and find they have been "sold," since such mica is utterly worthless for dynamos. For electrical purposes the mica must be in perfectly even plates, free from buckling or corrugation. It must not be perforated or cracked in any way. In another part of this report **Professor Dunstan** says: "They (the plates of mica) should be roughly trimmed square or oblong, no piece to have more than five sides." This is incorrect. Bengal mica is seldom, or never, cut square or oblong. It is roughly sickle-dressed to any shape the plate will give, round, zig-zag, or polygonal. Again: "Care should also be exercised not to pack in the same case plates of mica varying more than one inch, in either length or breadth." Mica shipped

THE INDIAN AGRICULTURIST.

from Calcutta varies far more than this. "Specials" are packed in the same case, and there may be anything from 36 square inches to 100 square inches. Number 1 are plates from 24 square inches to 36 square inches, and all of these go in the same case. "There is practically no sale for plates less than 2 *inches in width.*" A reference to any electrical mica dealer's price-list will show that high prices are asked for 'steeps' 1½ inch wide and 6 inches long. I could point out several other serious errors, but I think I have shown enough to prove that the pamphlet ought to be withdrawn from circulation, as it is likely to do more harm than good.

MICA MINER.

[We comment on this letter in our leading columns.—ED.]"

REMARKS BY PROFESSOR DUNSTAN.

Remarks on a letter in the "Indian Agriculturist" for August 1900, on Mica from Jaipur, by Professor Wyndham R. Dunstan, M.A., F.R.S., Sec.C.S., ***Director of the Scientific and Technical Department of the Imperial Institute.***

The anonymous writer "Mica Miner" in *The Indian Agriculturist* of August last, who criticises my report on some samples of mica from Jaipur (*Agricultural Ledger, 2,* 1900) which embodied the recommendations of one of the largest mica brokers in this country, has evidently misunderstood my meaning, and appears to be misinformed as to what the requirements of the British market are in this article.

As the circulation of his letter in India may possibly mislead mica producers, at the request of the Reporter on Economic Products I make these few remarks on the letter in question.

When I wrote "this kind of mica is only adapted for electrical purposes," I obviously intended to refer to this *variety* of mica —known as "black-spotted"—in contra-distinction to the clear "ruby mica" which is, as I stated in the next sentence, suitable for the construction of chimneys for stoves and lamps. I did not, as my anonymous critic assumes, recommend the cracked and striated samples submitted as being suitable for electrical purposes, but, on the contrary, in the preceding sentence condemned them as "quite worthless." His remarks on this point are, therefore, uncalled for,

MICA. | On Samples of Mica from Jaipur.

REMARKS BY PROFESSOR DUNSTAN.

and the information he gives is common knowledge to all who are concerned with mica in this country.

The rest of the letter severely criticises as likely to do harm, the recommendations of the London mica experts who were asked for a commercial opinion on the samples from Jaipur, I have drawn their attention to the criticisms, and they remark :—

"We are probably more interested in mica than any other firm, seeing that we dispose of 1,000 cases monthly to all parts of the world, and we still adhere to the advice given in our Notes. While the remarks made by the writer as to the customary packing in Bengal are practically correct, we fail to see that the custom there followed is the best for miners, and it certainly is not from a dealer's or consumer's point of view, and after all, in these days of severe competition the miners who pack their produce to meet the requirements of the trade, certainly dispose of their goods promptly and to the best advantage.

"If the critic had made enquiries at the most progressive mica-producing centre of India, which is at present Madras, he would have found that all miners there follow the lines we have intimated, and the result is a largely increasing output. We may state that seeing that 75 per cent. of the mica bought by the actual consumer has to be trimmed to a rectangular shape, it is self-evident that 'sickle-trimmed' mica is not by any means preferable, but rather the contrary.

"With regard to the width of plates, there are, of course, occasions where mica of less than 2 inches broad is required, but we do not advise miners to send forward strips unless at least 6 inches long. We stated in our notes 2 inches broad, as we are constantly requested to value scraps of mica measuring such sizes as 1 × 1, $\frac{3}{4}$ × 1$\frac{1}{2}$ and so on, which are valueless. From the old established mines a sufficient quantity of narrow mica already reaches the market and has to be disposed of at not very remunerative rates.

"It is of course impossible in a short report to go into all the details and requirements of a trade, we merely sought to give intending miners a broad outline of the general requirements, and we repeat that as selling brokers for the largest shippers in the world, we claim to know the actual trade requirements better than the anonymous writer whose knowledge of mica is evidently limited.'

On Samples of Mica from Jaipur. (*W. R. Dunstan.*)

MICA.

REMARKS BY PROFESSOR DUNSTAN.

I may add that it is all important at the present time that mica miners in India should be advised to reject the views of "Mica Miner" and pay close attention to the requirements of the British market, since excellent mica is now being mined in several British Colonies and is competing severely with the Indian product.

G. I. C. P. O.—No. 805 R. & A.—10-5-1901.—2,234.—G R.

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